SCIENTIFIC AMERICAN

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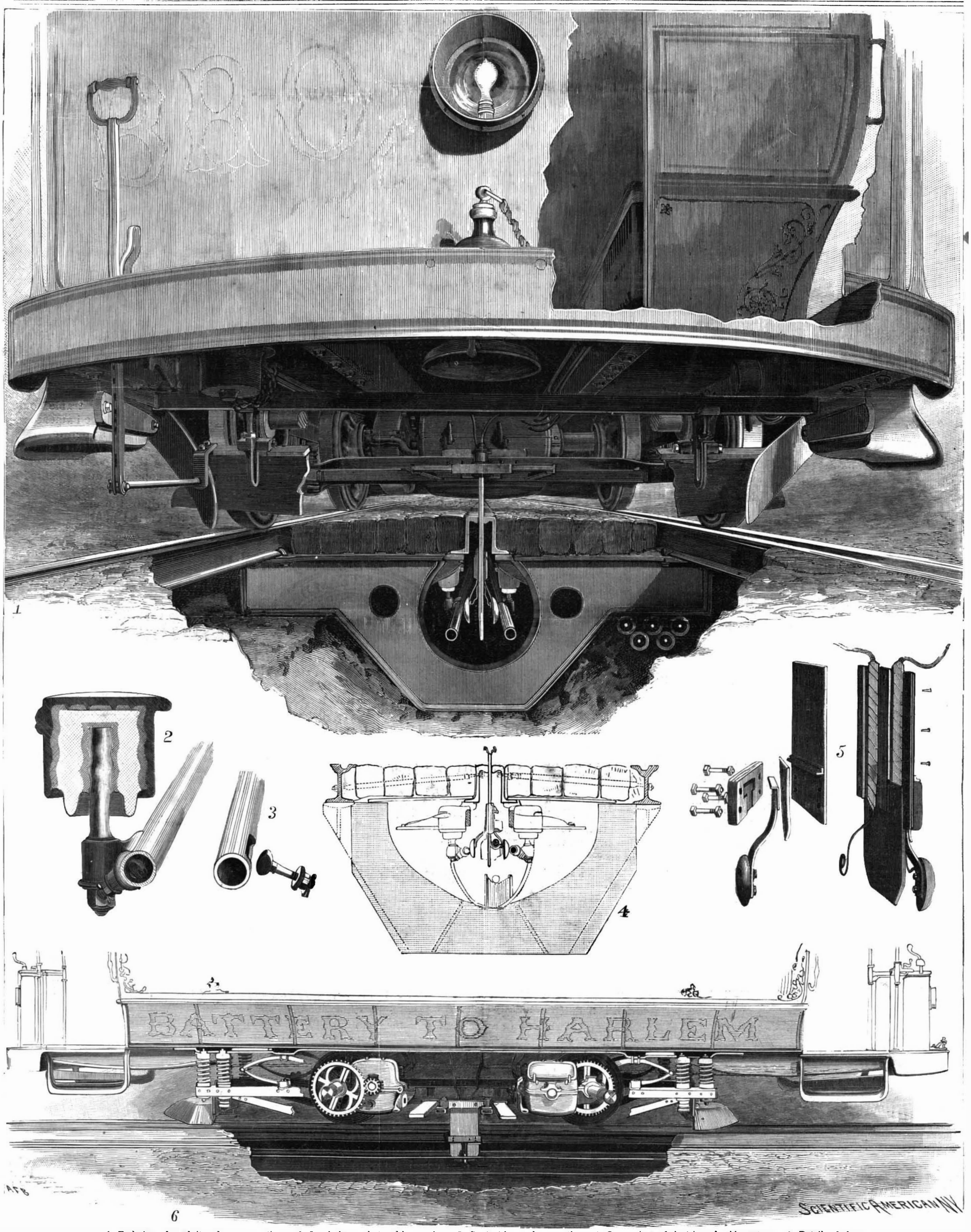

1. End view of conduit and car connections. 2. Insulating socket and hanger bar. 3. Contact bar and connection. 4. Comparison of electric and cable systems. 5. Details of plow. 6. Side view of car truck, motors, and conduit.

THE UNDERGROUND TROLLEY STREET RAILWAY IN NEW YORK CITY.—[See page 119.]

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NEW YORK, SATURDAY, FEBRUARY 22, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1051.

For the Week Ending February 22, 1896.

Price 10 cents. For sale by all newsdealers.

THE TRANSPORTATION PROBLEM IN NEW YORK CITY.

We have shown in a preceding issue that the difficulties of the rapid transit question in New York are caused by the peculiar nature of the site upon which the city is built—an extended peninsula with a broad belt of water hemming it on three sides—and that there would be a prejudice against any scheme of underground transit which would seriously imperil its success, should it ever be built. The statistics of the amount and increase of travel in recent years prove very clearly that, bad as the crowding on the leading lines of travel now is, it will rapidly become much worse. The situation calls for immediate action; and unless some means be devised of quickly enlarging the present carrying capacity of the Brooklyn Bridge, of the elevated roads, and of the Broadway cable road, we shall see at no very distant date a veritable deadlock on these lines of travel during the morning and evening rush to and from the lower city.

The Elevated Roads.—The simplest and most natural way to enlarge the capacity of the elevated roads would be to lay two additional tracks; widening the existing structure wherever it might be necessary. The two outer tracks could be utilized for local traffic and the two inner tracks for the through traffic to Harlem and the suburbs beyond. This scheme would involve the four-tracking of the Third and Sixth Avenue lines, whose carrying capacity is at present the most heavily taxed. On the Third Avenue line the four-tracking could be completed without a break from City Hall Park to the Harlem River; and from Chatham Square to South Ferry it would be possible, by reducing the distance between centers of tracks to the smallest allowable limit, to lay a third track. On the Sixth Avenue line two extra tracks could be laid from Chambers Street to Harlem, and there would be room for one extra track from Chambers Street to the South Ferry. At the turns at Third and Fifty-third Streets the lack of space would necessitate a separation of the four tracks, two of them being carried around the block and through the next cross street; but this arrangement would present no difficulties in the operation of the road. With such an extension of the system the elevated roads would be capable of handling their traffic with facility and at a greatly accelerated speed. By utilizing the inside tracks for a swift through service to the upper city, a large portion of the traffic could be picked up at suitably chosen downtown stations, and carried to the Thirty-fourth Street Ferry, the Grand Central Station, or to the outlying districts at or beyond the Harlem River, in one-half the time that is now consumed on the journey This would instantly relieve the crowded state of the local traffic; and the interest on cost of the new construction would be more than covered by the receipts from the increased travel to the upper city which would follow upon the opening of so vastly improved a service.

Such an enlargement of the capacity of the elevated roads would not only relieve the present overcrowding, but it would prepare them for the increase of travel which will result from the completion of the new East and North River bridges. These bridges will attract a considerable portion of the present ferry traffic to themselves; they will also carry a large through traffic, which will converge to them from the New Jersey and Long Island suburbs; and the bulk of this travel will be unloaded upon the elevated roads. With their present equipment they would be quite powerless to take care of it; but with a separate express line, as above suggested, they could quickly run these passengers to their downtown destination.

The Broadway Cable Road.—Next in importance to the elevated roads is the Broadway cable road, which runs through the main artery of the city's business and travel—one of the longest, richest, and most busy thoroughfares in the world.

The travel upon this road is at all times of the day heavy, and during the morning and evening "rush" the overcrowding is even worse than that upon the elevated system. It frequently happens between the hours of five and six at night that the inside of the cars and the platforms are so crowded with standing passengers that it requires brute strength to wedge one's way through in order to alight. Ladies form no small percentage of these herded patrons of the road; and it is a matter of daily occurrence that lady type-writers and clerks, who are returning home, wearied with their day's work in the city, have to stand on the platform, in such a crowd, often subject to the exposure of the weather, for a distance of twenty or thirty blocks!

It is impossible to increase the capacity of this road by the means suggested for the elevated system. The existing tracks, as it is, are a serious obstacle to vehicular traffic; and the laying down of any more is out of the question. For the same reason it would be inexpedient to run two or three cars coupled together; stopping at the crossings, they would seriously interfere with the east and west bound traffic. There is another means of increasing the capacity of the road, which, though it is comparatively novel in America, would be perfectly feasible, and that is by double-decking the cars. By resorting to this expedient the accommodation of the system could be doubled in a comparatively short time.

The double-deck car is not an experiment: it has been tested, and is now running on many of the street lines of European cities. The upper story is a duplicate of the lower story, and it is reached by a winding stairway at each end of the car, which is provided with a stout hand rail; the steps, risers and sides of the stairs being formed of solid plating. Such a car will carry upon the same length of wheel base just double as many passengers as the ordinary car.

By placing upon the road a limited number of double-deck cars and running them during the busiest hours of the night and morning traffic, the cable company would be prepared for all emergencies and could give its patrons what they pay for, and what at present more than half of them seldom get—a s. at.

The objection will be urged that the swing of the cars in rounding the street corners would be liable to throw passengers from the stairways, and to meet this it would be necessary to substitute transition or easement curves for the present sharp and most uncomfortable curves; such, for instance, as exist at the entrance to Union Square.

The transition curve commences with a very small deflection angle, which increases gradually as the curve proceeds. By this means the violent lateral lurch, which now makes travel hideous at such points on the line, is avoided; the car being imperceptibly deflected from the tangent upon which it has been running. This alteration, coupled with the insertion of a super-elevation in the outer rail of 1¾ or 2 inches, would enable cars to round these curves with a smoothness of running which would be a revelation to Broadway travelers.

The adoption of such cars would necessitate raising the superstructure of the elevated road some 5 or 6 feet, at such points of crossing as occur at Thirty-third Street; and the columns would have to be lengthened by varying amounts for a distance of 500 to 600 feet on each side of the crossing, so as to carry the roads over on an easy grade.

This scheme for the relief of Broadway traffic could be quickly carried out, and, in view of the immense relief it would bring, its cost would be moderate. It is perfectly practicable; and the reserve of carrying power which it would place at the disposal of the company would enable them to cope with any possible increase of travel for many years to come.

The Brooklyn Bridge.—Perhaps the most seriously encumbered line during the busiest hours of travel is that across the Brooklyn Bridge. Here, more than anywhere else, some immediate plan of relief is called for, and it is gratifying to learn that with the opening of the new terminals, and the doubling of the present switching capacity, it will be possible to decrease the headway between trains from 1½ minutes to 45 seconds. This will double the capacity of the cable road, and should go far to relieve the present overcrowding. The report of the board of experts, in accordance with whose suggestions the present improvements are being carried out, states that "if, as is probable, the headway can be made 40 seconds, the capacity for four-car trains will be 36,000 per hour," as against the present capacity of 16,000, "and for five-car trains 45,000 per hour, assuming that passengers insist upon crowding the trains to the extent of 100 per car rather than wait."

Should the increase of travel in the future be so great as to overtake this enlarged accommodation, it would be feasible so to strengthen the stiffening trusses through which the present cable line runs that they could carry upon their top chords an electric trolley line, operating single cars; and this could be done without materially raising the unit of stress throughout the main members of the bridge itself. If the tracks were laid well over to the inside, as close to the vertical cables as practicable, comparatively light floorbeams could be used, and it is likely that the posts on the inside truss alone would have to be stiffened. By laying directly upon these floorbeams stringers of a trough section, with the rails placed centrally within them without the intervention of cross ties, a very light floor would be secured If the cars were run singly, any serious concentration of rolling load would be avoided, and the combined stresses resulting from the dead and live loads would not, it is certain, call for any considerable strengthening of the existing trusses beyond what was above suggested.

The trolley line would run above the present cable line until the end of the trusses was reached, when it would swing out over the roadway on either side, finishing in a loop in front of the present terminal stations. The cars would thus run on a continuous track, without switching; and they could handle the traffic at the curved platforms, which would be located at a sufficient height to clear the existing cable car line.

The increased capacity of the cable road resulting from the opening of the new terminals, supplemented at an early date by a light trolley line, as indicated above, would provide adequate seating capacity, until the opening of the new bridge further up the river shall permanently relieve the situation.

ROENTGEN'S DISCOVERY.

During the last week innumerable reports of work in X ray photography have appeared in the columns of the various journals, scientific and otherwise, but with comparatively little new matter in them. It still appears that Prof. Roentgen gave the matter so thorough a treatment before publishing his results that it has taken the rest of the scientific world a month to catch up with him. It is said that photographs taken by him are better than the majority of those taken by other experimenters. His modest paper on the subject of his discovery has not been exceeded in interest, clearness of statement, and precision of deductions, by all which has been published since.

Prof. Roentgen's discovery is shown in that paper, given in our SUPPLEMENT, No. 1050, to have been developed from experiments with a fluorescent surface. Such a surface he found was rendered luminous by the X rays after they had passed through an opaque screen. To go from a phosphorescent surface to the sensitized photographic plate was quite natural. Now we hear of an investigator retracing this step and returning to the phosphorescent plate with the most interesting results.

Prof. Salvioni, of Perugia, on Saturday, February 8, read a paper before the Rome Medical Society, describing an apparatus of his own invention which enables the eye to see the Roentgen effect. As imperfectly described in a cable from Rome, a tube is employed and the shadow produced by the X rays is cast upon a fluorescent surface, the object to be examined having been placed between the observation tube and the Crookes tube. A perfect shadow is thus procured, and the outer end of the tube is provided with a lens by which the image may be intensified for purposes of examination. It is a substitution of the retina of the eye for the photographic surface, with this difference, that to produce a visible effect the Roentgen rays have first to produce true light rays. This they are made to do by a fluorescent surface. It will be seen that this is merely a reproduction and development of Roentgen's first experiments, for if the rays can render a fluorescent surface luminous, the possibility of the production of shadows upon such a surface almost necessarily follows. Prof. Salvioni calls his highly interesting apparatus the cryptoscope. When the stethoscope was first invented, it was hailed as a great achievement in revealing to the auscultator the secrets of the operations of the human system. But if the cryptoscope can be sufficiently developed, it will place a more powerful instrument of research in the physician's hands, by which he will be able to see the shadows of the bony framework of the animal system without an appeal to photography.

We present our readers with a portrait of Prof. Roentgen, and the following notes of his biography will be of interest.

Wilhelm Conrad Roentgen was born in 1845 in Holland. He graduated at the University of Zurich, taking his doctor's degree at the age of twenty-five. At this university he was the favorite disciple of Prof. Kundt. When the latter left Zurich for Würzburg, Roentgen went with him, and the two next received appointments in Strasburg University as professor and assistant respectively. This was in 1873. In 1875 he held the chair of mathematics and physics at the Agricultural Academy of Hohenheim in the kingdom of Württemberg.

Hohenheim is a hamlet some four miles south-southeast of Stuttgart, little known except for its school of agriculture. He returned a year later to Strasburg, and in 1879 was professor in and director of the University and Institute of Physics in the old university town of Giessen, a city rendered illustrious before this time by the labors of the great Liebig. In 1888 he returned to his old college at Würzburg, where he now holds his professorship. His published papers began to appear in 1873. The isothermal surfaces of crystals and calorimetry of the sun, using an ice calorimeter; electrically produced dust figures and transmission of the electric discharge through gases; diathermacy, a new aneroid barometer, flame sounds, and the telephone are typical subjects of his original investigations.

His essays may be found in Poggendorff and Wiedmann's Annalen, the Zeitschrift für Kristallographie, the reports of the Vienna Academy of Sciences, of the Gesellschaft der Wissenschaften of Göttingen, as well as in those of the Gesellschaft fur Natur und Heilkunde of Upper Hesse and of the Physico-Medical Society of Würzburg.

We are indebted to L'Illustration for the portrait of Prof. Roentgen which we reproduce with this article.

WILHELM CONRAD ROENTGEN.

THE COMPARATIVE ECONOMY OF THE ELECTRIC AND THE CABLE CAR SYSTEMS.

Writing under the title, "The doom of the cable in San Francisco," Mr. S. L. Foster, in a communication to the Street Railway Journal, gives an account of the recent change of a San Francisco road from the cable to the electric system.

The writer's deductions are based upon the experience of the Market Street Railway Company, which owns both electric and cable roads, and "has been making data for itself."

The conditions for the test were excellent, for the reason that the climate is favorable to cable traction, there being no snow or ice to prejudice the results against the cable; and, further, that the original construction and present working condition of the San Francisco cable roads is unsurpassed. As the result of its experience with the two systems, "the Market Street Company has become convinced that the people prefer to ride on the electric cars, and that the electric cars carry the people more cheaply then does the cable. These results were not obtained from a few electric cars run on level lines and at high rates of speed, but from the operation of upward of 150 cars at from 1½ to 2½ minutes headway at times, and on lines having grades as high as 14½ per cent. Most of these cars are subject to frequent interference from the heavy wagon traffic on the downtown streets, and all of them are governed by the rule ordering a reduction of speed at the crossing of each intersecting street."

The first experiments of the company in electric traction consisted in the electric equipment of its old horse car lines. Next, a route for which $30,000 worth of cable had already been purchased was similarly equipped; and the continued success of the experiment led to a general order that electric roads should be laid down on all new franchises. The most startling decision of all, however, was that which ordered the abandonment of the cable on Ellis Street, and the substitution of electricity; for not only was this particular line paying well at the time, but it is a line with many long and heavy grades—conditions which are generally supposed to be unfavorable to electric, and calling specially for cable traction. The superior economy of the system is thus summed up by Mr. Foster: Every time a cable power house can be dispensed with and the lines operated by electricity, that power house's item "labor" is wiped out, and the item "fuel" is reduced both on account of the less fuel required per car mile for an electric road as against a cable road and because the cable houses are usually run non-condensing, whereas in the electric power house the engines are run condensing. The original Ellis Street cable line was 9,600 feet long; and of this, 6,750 feet was changed to single track and 2,900 to double track electric road.

The cable road was 3½ feet gage and 11½ feet centers, and the electric single track was laid between the two cable tracks. In changing the 3½ feet gage to 4 feet 8½ inches on the 2,750 of electric double track, ties were laid, as before, between the two tracks, and the inside rail of each track moved out onto the center ties. The yokes and the concrete tube were left untouched. The cable also was left in the tubes, and will be utilized for the return circuit.

In addition to the above important change, the Oak Street line, whose cable is 26.000 feet long, is being reconstructed as an electric road, and as soon as this has been done, the two large power houses, which have run this and the Ellis Street cable, will be closed.

San Francisco may be called the cradle of the cable road system. It was in 1873, or over 22 years ago, that the Clay Street cable, the first street railway of this kind in the world, was built; and the object of the use of the cable was to overcome the grades of from 10 to 16 per cent that exist on that street.

To any one who is acquainted with San Francisco and has ridden over the precipitous grades of its cable roads, this substitution of electrical traction will be very significant, and we feel the full force of Mr. Foster's conclusions: "When we consider the daily spectacle of electric cars, unaided, climbing 14½ per cent grades in San Francisco and 15 per cent grades in Oakland, and by means of a simple auxiliary device ascending a 25 per cent grade in San Francisco, where no cable grip could be made to hold, the impregnability of any cable proposition is open to question."

Trees Fired by Electric Wires.

Citizens of Brooklyn, N. Y. were treated to an unusual exhibition of pyrotechnics on the evening of January 24, when three big trees became charged with electricity and sparked and crackled so that the neighborhood was illuminated and finally the firemen were brought to the scene. An arc light wire passed through the branches of the big trees and it is thought that the high wind of the day had caused the insulators to become worn, so that enough electricity escaped from the electric light wires to cause the display. At one time it looked as though houses in the neighborhood would be set on fire. The police were summoned and finally the firemen. After two hours' work the firemen succeeded in extinguishing the flames. The adjoining trees on the block then began to throw out sparks from their branches and the firemen were kept busy throwing water on the streams of fire, until the electric light company were ordered by the fire department to switch off their dynamos. A gang of linemen were then sent to string a new wire. Property in the neighborhood was damaged to the extent of $1,500.

A New Tunneling Machine.

An inventor is having built a machine by which he proposes to revolutionize the present methods of tunneling, the capacity of the device for "sawing out a tunnel," as claimed, being at the rate of twenty-three feet a day. The apparatus is described as being twelve feet long, four feet wide, and six feet high, and, with the fourteen horse power engine which runs it, weighs some 6,300 pounds. The principle is that of a circular saw. Sixty drill points attached to each of two wheels, four feet in diameter and eight inches wide, make 600 revolutions per minute. The points are one-half an inch apart, every revolution feeding one-eighth of an inch, and the enthusiastic inventor declares that it will cut twenty feet of a six by eight tunnel in a day in the hardest rock. The latter, being crushed as fine as wheat grains, is carried to the rear and dumped in a car. The drill points weigh one-fourth of a pound each, last four days, and are kept cool by means of a steady stream of water. Three men are required to run the machine.

The New Photograph.

The new photography has moved the English heart to poetry. The following verses are not by the new Poet Laureate, but they shed new light upon the future uses to which the shadow pnotograph may be put. Our thanks are due to London Punch, to whom we are indebted:

O Roentgen, then the news is true,
  And not a trick of idle rumor,
That bids us each beware of you
  And of your grim and graveyard humor.

We do not want, like Dr. Swift,
  To take our flesh off and to pose in
Our bones, or show each little rift
  And joint for you to poke your nose in.

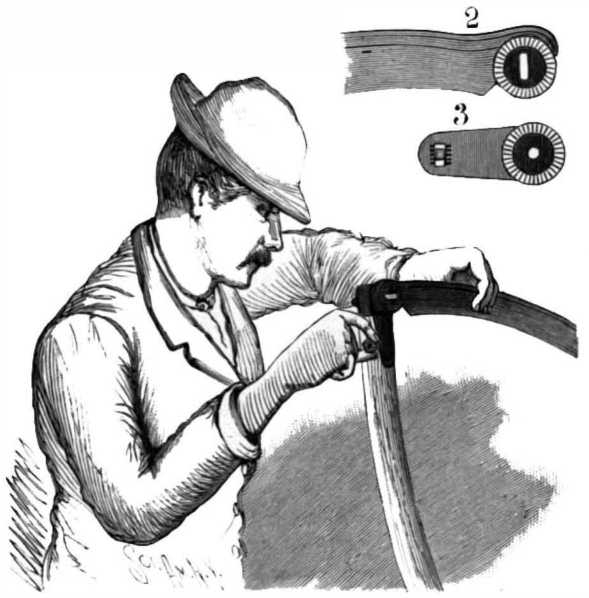
We only crave to contemplate
  Each other's usual full dress photo;
Your worse than "altogether" state
  Of portraiture we bar in toto!

The fondest swain would scarcely prize
  A picture of his lady's framework;
To gaze on this with yearning eyes
  Would probably be voted tame work.

No, keep them for your epitaph,
  These tombstone souvenirs unpleasant;
Or go away and photograph
  Mahatmas, spooks, and Mrs. Besant.

A READILY ADJUSTABLE SCYTHE.

The illustration represents a device adapted to facilitate the adjustment between the blade and snath of a brush, a cradle, or a hay scythe, enabling the operator to adjust the blade at any desired inclination to the snath, by means of a gage engaging the heel portion of the scythe and the contacting portion of



FREDERICKSON'S SCYTHE-ADJUSTING DEVICE.

the snath. The improvement has been patented by Christian Frederickson, of Cameron, Wis. Fig. 2 is a plan view of the heel portion of a scythe blade, and Fig. 3 is a bottom view of a plate having interlocking engagement with the blade, and for attachment to the snath, according to this invention. The annular toothed rib on the scythe heel has a transverse slot, and on the opposite under face of the heel are right-angled recesses, in which fits the head of the bolt by which the scythe, with the interposed adjusting plate, is attached to the snath. The adjusting plate has a clutch surface for interlocking with the similar surface on the heel of the scythe, and at the other end of the plate is a transverse slot, with teeth at each side, the slot receiving a squared portion of a bolt by which the plate is locked upon the snath, which rests upon the upper face of the plate. By loosening the bolt at the heel of the scythe, the blade may be adjusted at any desired angle, the clutch of the adjusting plate being brought into proper registry with the clutch of the scythe heel, and the bolts holding the respective parts firmly in the desired position. By this construction also the heel of the scythe blade is materially strengthened.

Explosion of an Aerolite.

A large aerolite exploded above the city of Madrid, Spain, at 9:30 a. m., February 10. The explosion was accompanied by the vivid flash of light and a loud report; the buildings were shaken and many windows were shattered. The concussion was so severe that the partition wall of the United States legation building collapsed and nearly all of its windows were broken. The officials of the Madrid Observatory state that the explosion occurred 20 miles above the earth. A general panic prevailed in the city.

Coal Consumption on French Tramways.

Comparative figures of coal consumed per car mile run on French street railroads, employing different methods of propulsion, are contained in an article on electric roads, by E. Cadiat, in the Portefeuille Economique des Machines of October and November of last year.

Storage Battery Traction.—On the lines at Paris from St. Denis to the Madeleine and from the Opera to Neuilly the car mileage aggregated in 1893 502,060, or per day 1,376 car miles. (The cars have room for 50 passengers.) The steam engines at St. Denis furnished for this service 250 horse power 23 hours and 125 horse power 6 hours, a total of 6,500 horse power hours, or 4·72 horse power hours per car mile. Mr. Badois, who reported these figures, gives 2·75 pounds of coal as the consumption per horse power hour, and arrives at 12 98 pounds of coal per car mile.

Trolley.—At Marseilles, during the first two weeks of operation, 150,348 pounds of coal were consumed to run 19,970 car miles, and during the second two weeks 150,975 pounds for 18,983 car miles. The average is 7 73 pounds, which, however, includes the coal used in lighting the cars and the power station.

At Havre the following figures were obtained during October and November, 1894. It took from 1·75 to 2 horse power hours to develop a kilowatt hour; 1·28 kilowatt hours were consumed per car mile, or from 2·24 to 2·56 horse power hours, equivalent to about 6·72 pounds of coal. The cars have room for 50 passengers.

At Milan, with cars having room for 34 passengers, 0·88 to 0·91 kilowatt hour, or 1·6 to 1·76 engine horse power hour, or 4·6 pounds to 5·0 pounds of coal produce one car mile. (From a paper by M. De Marchena.)

Compressed Air Traction.—The line at Nogent-sur-Marne has grades of 4, 4·5, 5·8, and 6·2 per cent. The cars have room for 50 passengers. Mr. Badois made a test from October 29 to November 4, 1894, and found 34·5 pounds of compressed air consumed per car mile.

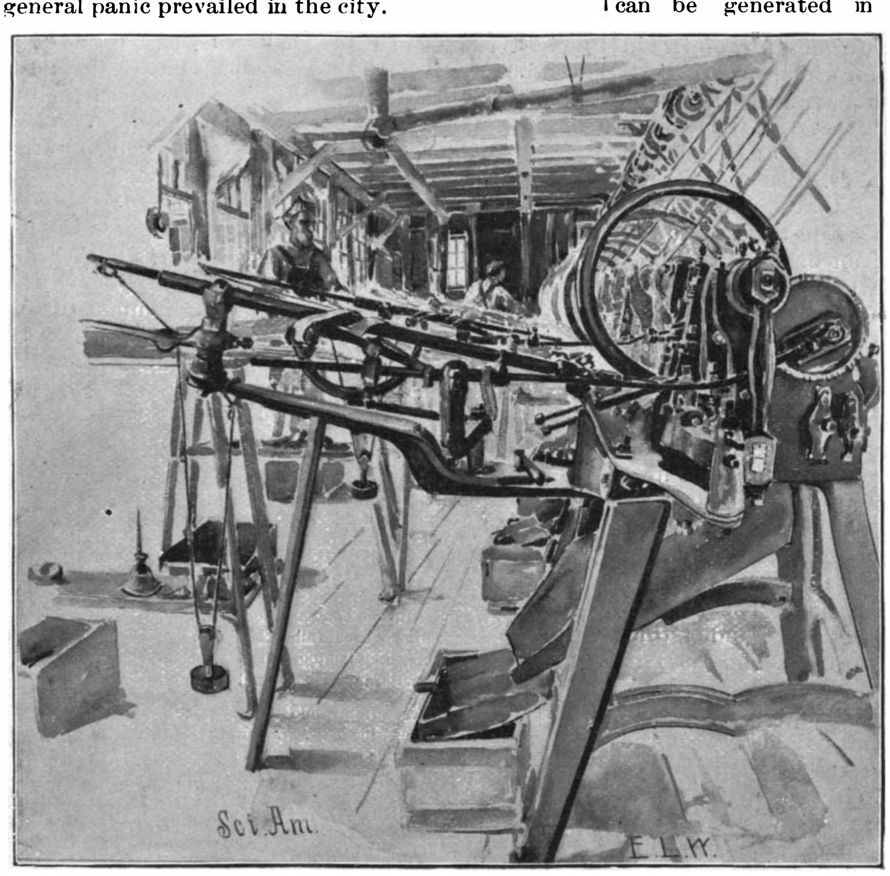
To arrive at the corresponding coal consumption, Cadiat makes the following considerations: In an engine, as there used, from 100 to 150 horse power, 17·6 pounds of steam will develop a horse power. One horse power delivered to an air compressor of good design will produce 10 pounds of compressed air at 600 pounds per square inch (the pressure adopted on said line).

Expressed in steam, the expenditure is, therefore, $34·5 \div 10 \times 17·6 = 60·7$ pounds, to which he adds $\frac{1}{12}$ for a certain loss, and arrives at 66 pounds of steam consumed per car mile, which, he states, can be generated in best French boilers with 4·8 pounds to 5·5 pounds of coal.

Lactates for Electroplating Baths.

Metallic lactates are strongly commended to electro platers by Dr. Jordis, in a communication made to the German Electro-Chemical Society. He affirms that lactic acid affords an excellent solvent in electro-plating baths, and yields good, adherent metallic deposits. He reports that he has succeeded in obtaining from lactate baths, coatings of copper and brass, of varying shades, on iron, zinc, and copper; of zinc on iron and copper; and of iron on nickel. Silver lactate yields a pure white coating of silver on amalgamated brass, which takes a high polish.

PREPARATIONS are in progress at Glasgow University for celebrating Lord Kelvin's fifty years' connection with that body.



STRIPPING SHEETS FROM WHICH TACKS ARE MADE.

THE MANUFACTURE OF TACKS.

In many villages and towns of southeastern Massachusetts, the manufacture of tacks, or "tacking," as it is termed, is one of the foremost industries. Abington, Whitman, Taunton, Middleboro, Plymouth, Kingston and other adjacent places furnish a greater part of the supply.

In Kingston much of the earliest work in this line was done, and here the first machine for making tacks was invented. The manufacture of tacks was begun in this section, about the year 1820, according to the memory of one of the oldest "tackers." Like all first products, they were rudely made.

At intervals, through the countryside an old man traveled from house to house, much as did the tinware man, and peddled tacks. This old fellow, a native of Taunton, named Albert Field, made his tacks by hand, using a vise and dies, and with a clamp so arranged that by pressing with his foot, the blank (a

BURNISHING TACKS IN THE "TUMBLER."

small piece of iron) was held, while with a hammer he fashioned the tack.

The inventive faculty of the Yankee found a field in making tacks, and soon a machine was invented in Kingston, by one named Reed. This contrivance cut a headless sort of tack. Melborne Curtis, of Middleboro, then invented a machine having a lever attachment, which headed the tack. About 1840 an improved machine, called the Blanchard, came into general use. About fifteen years ago, steel was tried. This was domestic steel, manufactured in Pennsylvania, Virginia and Ohio.

The majority of shoe tacks are cut from Bessemer steel. Shoe tacks have been used only about forty-three years, the first having been made in Whitman, by H. H. Brigham and Deacon Cook. These tacks are fine, with small heads, so that the awls and other sharp tools used by the shoemakers cannot be greatly injured by contact.

The machine tack is finely pointed, quickly forced into leather, and remains standing firmly until driven. To test the point, a tack is pressed into the thumb nail of the "tacker," when if it penetrates and stands easily, it is considered all right. Twenty-five or more different varieties of shoe tacks and nails are used for shoe manufacture.

Among the many styles are the roundhead, flathead, brass, countersunk, shankhead and lasting, while new styles are constantly being made.

A large supply of tacks is exported. Quantities go to England, South America, Australia, France and Germany. The sheets of rolled steel come in bundles, usually thirty-six by twenty inches.

When ready to be used, a workman called a "scaler" takes these sheets one by one, and puts them into a vat of vitrol, which removes the scales. When the scale is removed, the plate is washed in water, and dipped into a bath of lime or white wash, which neutralizes the acid. Another workman passes the sheets

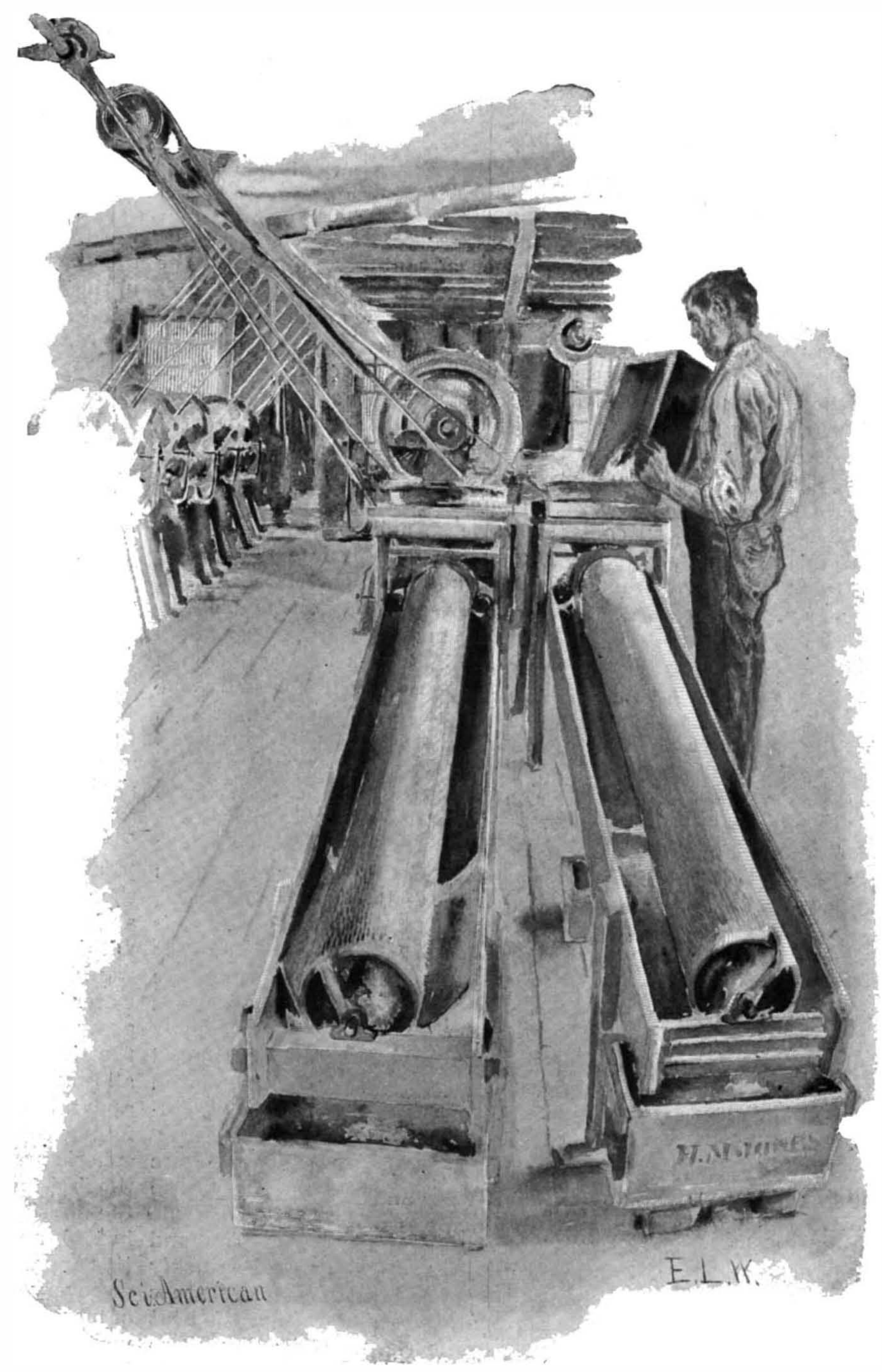
into the jaws of a great machine which cuts them into slender strips twenty inches long.

The man in charge of the line of machines then goes from one to another, placing in the end of a long wooden shaft one of these strips. The steel strip is forced by an arrangement for feeding it into the jaw-like aperture, where a tack is quickly bitten from it, headed and dropped beneath, where it makes one of many others already received in a box, which when full is replaced by another. At each revolution of the machine one tack is made, and two hundred and seventy in a minute.

The tacks are then poured by the boxful into another machine called the "rattler" or "tumbler," whereupon the tacks are "rattled" about thoroughly, and an air blast forces out the dust of lime, while the friction caused by their contact with each other gives them a peculiar luster; black lead is also used with them as a factor in the burnishing process.

They are then taken to the "sifter," an ingenious but simple machine for sorting them. A boxful is poured into a hopper at the head of the "sifter," and passes down into a slowly revolving, perforated cylinder, which is set at an incline. This is punctured with narrow and quite long holes, too narrow for a headed tack to go through. Down this cylinder the tacks slowly sift. Those that are perfect drop into a box. The imperfect ones, either headless or too small, drop through the perforations into receiving waste boxes.

In the packing room young women put the tacks into pound packages. An experienced energetic girl can pack sixteen hundred pounds a day, which is considered good work, as the average is ten hundred.



CUTTING TACKS 270 A MINUTE.

REMOVING SCALE FROM THE SHEETS IN MAKING TACKS.

The Pioneer Technical Schools.

In an address before the Engineering Association of the South, delivered at the annual meeting at Nashville, Tenn., on November 4 of last year, President Dudley gave a deal of information upon the early history of technical training. His subject was the "Development of Technical Education in the United States," and we are indebted to the Inland Architect and News Record for the following notes:

The first school in the United States to give a course of engineering was the United States Military Academy at West Point. The first two students who graduated as engineers graduated there in 1802. The military academy continued to graduate the only engineers in this country until 1840, when the Rensselaer Polytechnic Institute graduated its first class of thirteen civil engineers, being the first graduates in civil engineering in any English speaking country.

The Rensselaer Polytechnic Institute was founded in 1824 by Stephen Van Rensselaer as a "School of Theoretical and Applied Science." In 1849 it was reorganized as a general polytechnic institute, and it still devotes itself to civil engineering, dividing the course into general and sanitary engineering.

The total number of engineering schools or schools giving engineering degrees, in 1889, was ninety-four. Previous to 1802 engineers were self-taught, and from 1802 they were either trained in the office of some engineer or graduated at West Point.

Until recently in New England, and at present in old England, "students" or pupils were apprenticed, so to speak, to practicing engineers. This custom, however, has never prevailed to any very great extent in the West. No articles were signed by the "pupil," but he was supposed to pay $100 per year for three years to the engineer in whose office he was serving, and he was paid 12½ cents per hour for his work in the field, which was credited on his tuition account. "After the war" this system began to die out, and the pupil was paid 12½ cents for his office work as well as field work, and in this way he could frequently more than pay his tuition. This, however, did not cause any loss to his "instructor," because his services were charged at a rate of from $2 to $6 per day, according to the skill of the pupil. By this system the pupil learned much or little, as he chose. He asked such questions as he pleased, and got such answers as he could, but what he learned he usually learned well, because he put into practice immediately and constantly what he learned.

Up to 1830 the word engineer conveyed to the minds of the vast majority only the idea of a military officer. The phrase civil engineer had been but lately coined. In 1828 the Institution of Civil Engineers was incorporated in England, and when civilians assumed the title they incurred the wrath of the military men. In 1835 the Rensselaer Institute first resolved to form a distinct "engineering corps," receiving on graduation the "Rensselaer Degree of Civil Engineer." As we have seen, their first class graduated in 1840.

The School of Engineering of Union College, at Schenectady, New York, founded in 1845, was the second in the United States. The third was the Lawrence Scientific School, at Harvard, founded in 1846. The fourth, the Sheffield Scientific School, at Yale, founded in 1847, nominally, but was not a live and active school until 1861. The fifth was the engineering department of the University of Michigan, founded in 1852. The sixth, the Brooklyn Polytechnic Institute, founded nominally in 1845, but did not begin graduating until 1866. The Columbia College School of Mines was founded in 1863 and opened in 1864. It was the first school in the United States in which mining was taught as a science. Here the college course in mining engineering started in the United States.

The Massachusetts Institute of Technology was incorporated in 1861 and began operations in 1865. In 1868 the first class, composed of thirteen, graduated.

The first degrees in mechanical engineering were conferred in 1868 by three institutions—Rensselaer conferring five, Yale one and Massachusetts Institute of Technology one.

Stevens Institute was founded in 1870; its electrical course was instituted in 1880. Sibley College, Cornell, was founded in 1870. The first civil engineering degree was given in 1871. In 1875 the course in electrical engineering was instituted, as well as a course in marine engineering.

The latest course in engineering is chemical engineering, which is given at the Massachusetts Institute of Technology.

Brussels a Seaport.

"Bruxelles Port de Mer" is the new name for the capital of Belgium, says the Nautical Magazine. The burgomaster signed a decree to this effect at the beginning of last month in anticipation of the contemplated ship canal. The present waterway by means of the Scheldt and the Rupel and Willebroeck Canal is 200 years old. The contract for this enlargement has now been signed and will provide for navigation by vessels carrying 2,000 tons. There will be a depth of 21¼ feet, obtained not by dredging but by raising the water level, and there will be three locks. Although provisions are made in the stone works for the above named depth it is not contemplated to exceed a depth of 18½ feet at first. The waterway is to be finished in five years, and the estimated cost is £14,000,000. At present the sea traffic of Brussels is not very extensive.

MINING SCHOOLS IN RUSSIA.—The Russian Ministry of Public Instruction has decided to establish mining schools on a large scale in the mining districts, especially in the province of Ekaterineslav. The school will cover all branches of the subject, and the idea will be followed up to a considerable development if the results are sufficiently encouraging.

Electric Heat in Dental Practice.

BY DR. LEVITT E. CUSTER, B.S., D.D.S., IN THE SOUTHERN DENTAL JOURNAL.

Electric heat, when obtained by heating a conductor that does not oxidize, differs from other forms of heat in that it is without gas, noise, or odor, and on that account is of special value in dental practice. Electric heat also differs from that obtained from other sources in that it can be controlled and regulated with the utmost precision.

No case in dental practice, or in any other practice for that matter, calls for a blast of air exactly at blood temperature, so much as an almost exposed pulp. And no instrument so nearly meets this requirement as the electric warm air blast. With air at a constant pressure, which is carried over electrically heated wires at a constant heat, the air escapes from the syringe nozzle at a uniform temperature. The heat can be varied by the operator in three ways: by manipulating the air pressure, by altering the electric heat by means of the rheostat, or by varying the distance of the syringe point from the cavity. After a little experience, the operator can dry out the cavity without the slightest pain to the patient, and, if the air has passed through a wash bottle of alcohol or any such agent, it carries its vapor with it.

The cautery and electric root drier are both familiar to you, and are examples, on a small scale, of the heating power of electricity. These instruments can both be successfully operated on the Edison current by throwing in about ten ohms resistance and taking off the cautery heat by what is known as a "shunt" current.

The value of any heat for sterilization is duly recognized, and for some time I have been satisfactorily using the electric oven, raised not quite to the beat of withdrawing the temper of the instrument. The heat may be maintained all day long, and the cleanliness and simplicity recommend it. Gutta percha is softened with accuracy, when placed on a soapstone slab resting on the oven, and the waste heat rising from the whole appliance is utilized for keeping water warm for the syringe.

There are two processes in dental practice which call for absolute purity and uniformity of heat. Upon recognizing the special fitness of electricity for meeting these conditions, I some years ago devised an appliance for annealing gold thereby, and one more recently for fusing porcelain.

The heat produced by electrically heating a mat of coiled platinum wire is the cleanest, most uniform, and most accurately controlled of all forms of heat. The cohesive property of pure gold is supposed to be developed by heating to such a temperature as to drive off the gases condensed upon its surface, principal of which is ammonia. The alcohol and Bunsen flame are ordinarily used for this purpose, but who is certain that better results may not be obtained by subjecting to a heat free from the products of combustion as well as to the danger of smoking and the exposure to unconsumed gases. The electric annealer effectually overcomes these dangers. The heat, being derived from electrically heated platinum, itself a noble metal, is absolutely free from gas of any kind. The heat is radiated from a mat of platinum coils and is quite uniform at all parts, so that the gold is not only thoroughly annealed, but is evenly annealed. It is impossible to evenly heat a piece of gold, held with a pair of pliers, over a flame of any kind. The thin edges of the gold will be fused, while the part between the pliers will be scarcely warm. The accuracy with which electric heat can be controlled also recommends its use for annealing. By means of the rheostat, any degree of heat to the melting point of platinum may be obtained. From my experience with the electric annealer, however, I find that cohesion is developed at a much lower degree than at first supposed. It is never necessary to heat even to redness, let alone fusion. The heat may be so low that the gold may be subjected to it for hours or for days, even, without any injury, and still be highly cohesive.

Electrically annealing gold saves time in many ways. The gold requires no attention, is ready for use at all times, and the heat not being high enough to take the temper from the plugger point, this instrument may be used to pick up the gold, thus saving the time of changing instruments. After six years' use, I am free to say that next in usefulness to the dental engine is the electric gold annealer.

The latest practical application of electric heat in dental practice is the electric oven for fusing porcelain. From the time of Allen and Hunter, or from the very beginning of porcelain work, the question of heat has been a serious one, and the principal reason that continuous gum has not been more popular is the difficulty and uncertainty in the production of heat. The heating principle of the oven is an electrically heated platino-iridium wire, or the gold annealer in the form of an oven. In using this new source of heat, I departed from the old muffled shaped oven to one more in keeping with this new agent. It consists of an upper and lower section, flask shaped, with an inner cavity amply large enough to contain a set of teeth, and of such form and arrangement of the wires that all parts receive the same degree of heat. Upon the whole inner surface is embedded the electric conductor, just deep enough to be supported while so highly heated, and yet to radiate its heat directly into the oven cavity. The upper half is hinged to the lower, which automatically makes the electric connection upon being closed. There are two openings through which the fusing process may be watched. These are placed at such positions that rays of light entering one will be reflected out by the plate through the other. This overcomes the intense glare of the heat, and at the same time brings the plate clearly into view, making it possible for an inexperienced operator to accurately determine the degree of fusion.

There are many other advantages offered by the electric oven.

The source of heat being a noble metal electrically heated, it will be readily seen that a heat is obtained that is unlike any heretofore used for this purpose; and since it gives rise to no products of combustion, it is an impossibility to produce what is known as "gassing," and porcelain fused by this method not only possesses unusual clearness, but appears to be more dense.

We can control electricity, and the opportunity is now open for any number of automatic appliances to regulate the heat according to the porcelain treated. I have, up to this time, devised a clock attachment to the rheostat whereby the current is gradually raised and cut off at a set time. Second, a fusible button of porcelain placed in the oven at the time of fusing, which rings a bell when the porcelain fuses. Third, an electric thermometer, whereby the temperature of the oven is quite accurately told by the rise of mercury in the tube. And fourth, an ammeter, the swing of whose arm is in proportion to the heat of the oven.

The cost of operating is very small indeed. The oven, as now made, consumes six amperes, which would be about two cents per fuse of thirty minutes.

In case a wire should burn out by accident, this break in the current automatically cuts the current off, so that no further damage is done, and it requires but a few minutes to repair the break in a way that is as good as new.

While the electric oven operates best when used on the Edison current, it is still very satisfactory on the 52 volt alternating, the 220 or the 500 volt currents.

In the practical operation of the oven the procedure is very simple. The case is placed on the tray in the lower section, and the upper is then closed down. The lever of the rheostat is placed on the first button, and heat for thoroughly drying out the case is quickly obtained. When the operator is satisfied that there is no more moisture present, he begins raising the heat by pushing the lever to the right. If he allows two minutes to each button, it will require from twenty to twenty-five minutes to reach the fusing point. If it is a crown or bridge, less time may be consumed in raising the heat without danger to the case, and it may be fused in from ten to fifteen minutes by throwing the lever over more rapidly. In practice I do not even measure off the time to each button, but fuse while I am operating. From time to time, as it occurs to me, I throw on two or three buttons at a time, according as the interval has been, until I have reached the third from the last button, on which it is allowed to remain until I have three minutes in which to give it my undivided attention. The porcelain is just ready to drop into a fuse, and upon throwing on the last button the successive stages and degrees of fusion are clearly made out.

In the first stage the porcelain is still in the powder form, and appears like snow; presently it begins to drop into a fuse, and the snow-like appearance changes into a dead, indistinguishable mass; the particles are now beginning to coalesce; gradually the surface, with all its inequalities, comes clearly into view, and presents a glistening appearance; continuing the heat a moment longer, the porcelain becomes more liquid, and the inequalities of the surface assume a more even appearance. Since the eye can be brought so close to the plate with the electric oven, and since the plate is brought clearly to view by the arrangement of the two sight openings, the operator is not guessing by the quantity of heat or the general appearance of the plate, but he is actually observing the different particles of the porcelain itself; and for that reason the fineness of his fusing is always assured, and under his perfect control. When the desired heat has been obtained, the lever of the rheostat si thrown back, which cuts the current off. At that very instant the heat begins to go down; so that there is neither overfusing nor loss of brilliancy in the gum color. If it is the first or second baking of the case, the stoppers need not be inserted, and the case can be taken out in a short time; but if it is the last fusing, after a few moments' time has elapsed and the case has become a dull red, the stoppers should be inserted, and the case allowed to gradually cool.

It would seem that electricity has given us all that we could ask for, and yet I am forced to say that the properties and applications of electricity are just unfolding, and the demands of dental practice of the future will keep pace with, if not in the lead of, electric progress. It is not a dream when I say the time is coming when electricity will have its place on the dental curriculum as much so as materia medica or metallurgy has now. No profession, science, or art has such varied demands in its practice as dentistry, and no single agent more nearly meets these than electricity.

A Convenient Homemade Barometer.

In the Weather and Crops, published by the Illinois State Weather Service, we find a short description of a simple instrument that serves the purpose of showing approximately the changes that may be going on in the pressure of the air. The description reads as follows:

"If a large-mouthed glass jar—fruit or pickle jar will do—be filled about two-thirds full of water, and in it be placed, inverted, a smaller long-necked flask, with mouth entering the water, the increasing or decreasing pressure of the outer atmosphere will cause the water to rise or fall within the flask. Clear, fine weather will be foretold by the water rising in the flask; stormy, wet, or bad weather by the water falling."

The device thus explained will, undoubtedly, show variations in atmospheric pressure, and all the more correctly in proportion as the temperature of the air within the flask remains stationary. If we wish to be at all accurate, or if we wish not to be misled by the effects of changes of temperature, we must either keep the temperature constant or else make a numerical allowance for the effect of its variations. If the temperature within the flask rises 1 degree Fahrenheit, its confined air will expand by $\frac{1}{492}$ of its volume, and the water in the neck of the flask will be pushed down to a corresponding amount. On the other hand, if the atmospheric pressure should diminish by 0·06 of an inch below a normal pressure of 30 inches, the air within the flask being slightly relieved of its pressure would expand by the $\frac{1}{492}$ part of its volume, and the water in the neck pushed down as before. In so far as we cannot rely upon the constant temperature of the air within the flask, we must therefore make an allowance of 0 06 for each degree of change. As this apparatus is so sensitive to temperature, it may therefore be considered as a thermometer when the atmospheric pressure is constant. In fact, this is known as the first form of air thermometer which was used by the physician Sanctorius, who learned it from Galileo in 1596, and it was the study of the fluctuations of this apparatus that contributed greatly toward the discovery of the pressure of the air and the invention of mercurial barometers and the ordinary spirit thermometer. If one wishes to use this apparatus as a barometer, and needs, therefore, to know its temperature correctly to within a degree, he will find it best to fasten the smaller flask and its long neck, or, still better, a long glass tube, permanently within the outer glass jar and fill the latter with water so that the whole flask is covered. A thermometer whose bulb is under the water will give the temperature of the water and the air within it, and, if the water be well stirred, all will have the same temperature.

An early modification of this simple barometer was for a long time manufactured by expert glass blowers in Florence, and was called the Florentine experiment. In this arrangement the inverted flask was made quite small, and weighted so that it floated freely like a small balloon in a jar of water; when the temperature of the water rose, or when the atmospheric pressure diminished, the air within the flask expanded and the density of the balloon diminished, so that it rose to the surface. If, however, the glass flasks are hermetically sealed so that the air within them cannot expand and change their density to any extent, then, if the water in the jar becomes warmer, the flasks will descend, because their own density will then be greater than that of the water. If, again, the open mouth of the jar be hermetically sealed, inclosing air above the water, we have a new condition, viz., the external atmospheric pressure has no longer any influence, while the changes of temperature have a twofold influence: by expanding the water its density is diminished, but by expanding the air above the water the quasi-atmospheric pressure within the jar is increased. These four combinations, namely, closed or open flasks floating in closed or open jars of water, formed what are known as the Florentine and the Stuttgart experiments with the Cartesian divers, and the phenomena that they exhibited were widely discussed by Europeans in the seventeenth century.—Monthly Weather Review.

Our Needs for Coast Defense.

Gen. D. W. Flagler, Chief of Ordnance, has appeared before the Committee on Coast Defenses and has stated that about $59,000,000 would be required to furnish the guns, mortars, and all that is required by the Ordnance Bureau to complete the defenses of the twenty-eight ports for which projects have been approved, including the fortifications on Puget Sound.

THE UNDERGROUND TROLLEY STREET RAILWAY IN NEW YORK CITY.

The Metropolitan Traction Company, of this city, having organized and put in operation their highly developed cable traction system, has now gone a step farther and installed an underground trolley system on part of its line, with the double view of working the portion of the road now equipped therewith by electricity and of extending it in the near future to other portions of their line.

For some reason the idea of an underground trolley system has been considered almost impracticable. Up to the present time the Buda-Pesth road and a short line known as the Port Rush road, near the Giant's Causeway, in Ireland, are the only two roads which have actually employed an underground electric trolley successfully for any length of time. Great difficulty has been feared from the entrance of dirt, moisture, snow, etc, into the conduit, destroying insulation, bringing about the formation of arcs, and involving other troubles. So true is this that a number of ingenious systems for avoiding these troubles have been devised and have been operated with more or less success experimentally, although they, naturally, are more complicated than the simple open conduit. The Metropolitan Traction Company has adopted the system of the General Electric Company, which is distinguished by great simplicity, dependence being placed more upon perfection of construction than upon any especial design for its protection from interference with its general working qualities. The conduit proper is of the typical construction used for the cable roads. This construction has been followed with the object of supplying a conduit for a cable if the electric system should prove unsuccessful or undesirable. Through the conduit on each side the contact bars are carried by hangers. The contact bars are connected laterally with feeder wires placed just under the outer shoulder of the iron casting. In the more recent portions of the installation, the feeder bar is a wrought iron pipe 1½ inches interior diameter and 2 inches exterior diameter. The pipe is inserted in 30 foot lengths and bonded at the ends with copper wire connections, bolted into the hanger slots. These pipes can be seen in our view of the cross and longitudinal section of the conduit and also in Figs. 2 and 3.

The hangers, of one of which we give a section, Fig. 2, depend upon a porcelain cup for their insulation, which cup is corrugated inside and out, and sits into a correspondingly corrugated cast iron cup, receiving in its central aperture the iron hanger rod, all being secured together by cement. To the lower end of the hanger rod a socket is bolted, and to this the pipe, in its turn, is bolted, the end of the bolt in the pipe passing through a slot 1⅝ inches long in order to provide for expansion and contraction by heat and cold. The head of the bolt is so shaped that it can be introduced into the slot, when by a revolution of 90° the bolt is secured to the pipe as shown in our cut, Fig. 3. The hanger bar is 1½ inches thick and 9 inches long, and the lower semicircular socket is attached to it by a swivel joint. This is the construction practically settled upon definitely, subject of course to minor changes if anything better can be evolved.

The electrical contact apparatus, termed the "plow," is attached to the car body and is built up of sheet steel, with wood and fiber insulation, its form generally being a parallelogram. When it is remembered that the slot itself is only ¾ of an inch wide, it will be seen how accurately the plow has to be constructed to correspond thereto in size. Its shank is $\frac{7}{16}$ inch in thickness, giving a clearance of a little over ⅛ of an inch on each side. To construct the shank two sheets of steel ⅛ of an inch thick are bolted together, and in the center and at the ends a central shoulder and end pieces are inserted for keeping them ⅛ inch apart, thus providing two passages between them of this width and 3 inches long going all the way down. This shank is 9½ inches wide, and descends well into the conduit. On each side of the lower portion of the shank are carried the contact shoes, which are seen in various views in our cut, especially in Fig. 5. These are castings, each being 4¼ inches by 2¼ inches, and ¾ of an inch thick. A single shoe is used on each side, although as many as three on a side have been used experimentally. They are carried by sheet steel springs 2¾ inches wide, which press them outward from the plow frame, as shown in Fig. 5. Under the influence of these springs they are pressed against the conductors with a pressure of about 7 pounds. The upper ends of the springs are clamped in place by bolts, wooden blocks and fiber sheet being used to insulate them from the plow frame.

The exact disposition of these parts is seen in Fig. 5, The springs are held in place by compression and by the hooked upper end, which enters a mortise in the wooden block. The fiber sheet is shown directly back or to the right of the detached spring. The same cut shows a heavy sheet of fiber descending down from the plow shank and between the springs to prevent any possibility of a short circuit. We have spoken of the channels that extend through the shank of the plow; through these pass copper conductors insulated with mica and tape wrapping (Fig. 5), one conductor for each contact shoe. Between the ends of the conductors and the shoes the connection is made by safety fuses, so that if too much current is put on, the burning out occurs at this point.

At the present writing the system cannot be called experimental in the usual sense, as it has operated with uniform success for nearly an entire winter, as well as during the less trying summer weather and the line is in daily operation and gives the greatest satisfaction. The Columbus and Lenox Avenue line is operated from a power house at 146th Street near Lenox Avenue. Here there are installed two multipolar dynamos, class B, of the General Electric Company, which at one hundred revolutions give a pressure of 300 to 330 volts each with an output of 1,200 amperes, but in practice they have been speeded up to nearly 150 revolutions, raising the voltage to 525. For each dynamo there is installed a 1,000 horse power cross compound Allis engine with Corliss valve motion, exhausting into the open air. To supply the engines there are two Babcock & Wilcox boilers, each containing 100 four-inch tubes 18 feet long, with 42 inch drums ½ inch thick and 23 feet long and capable of working at 180 pounds. At present cars are run by electricity on this division from below One Hundred and Sixteenth Street on Columbus Avenue to Lenox Avenue and One Hundred and Forty-sixth Street, but ultimately it is proposed to extend the electric system to other roads in the city. The Eighth Avenue road is the next one of the old roads to be equipped. It has been found that the conduits do not accumulate dirt, that the loss of current is not worse than on an overhead trolley, and the conduit has proved to be practically self-cleaning, requiring to be swept out perhaps two or three times in a year, the natural flushing of the rain doing the greater portion of the cleaning. It is made, of course, self-draining.

Fig. 4 is a cross section of the conduit drawn to illustrate the relation of the cable and electric systems. It shows where the working and idle cable in the cable traction system are situated, and gives the position of the parts of the electric system very clearly.

Manholes are placed along the line, never less than 250 feet apart. At them are placed sewer connections for carrying off rain water. Over each insulator is a handhole beneath the street paving blocks easily reached by raising a few stones.

Each car is provided with two 25 horse power motors, with electric heaters and electric lamps, including headlight.

A very noticeable feature about the operation of the cars is their smoothness of operation. They start without the jerk which is so pronounced on the cable roads, and the extension of the system to other roads of the city will be a decided improvement on existing systems. The system is interesting also as not using a return grounded circuit, so that electrolysis of water and gas pipes will be avoided.

The Non-refillable Bottle.

Bonfort's Wine and Spirit Circular of January 10 contains an exhaustive article on the above vexed question from the pen of a writer who signs himself J. C. G. It opens with the remark that "for many years it has been the general belief that there has been systematically practiced a fraudulent custom of substituting an inferior grade of liquors in bottles originally containing a superior brand, resulting detrimentally to its reputation, aside from probable serious financial loss to those whose output is deservedly in good repute."

It is recognized by the trade that the only effective way to prevent this fraud is to provide some mechanical device within the bottle which shall make it practically impossible. A whole army of inventors have spent much time and money in the attempt to provide this much-needed device; but at the present time there appears to be no such bottle in the market as meets all the necessarily exacting conditions laid down by the trade.

"There have been so many devices submitted for approval, and invariably objected to for one reason or another, that the trade seems weary of being importuned, and it is gradually beginning to consider the idea impracticable and to regard inventors as 'cranks;' while the glass manufacturers, having been surfeited in the matter of making trial samples, are free to admit they prefer not to be troubled by such work, and if they can be prevailed upon to do the work at all, they do it at their own convenience, which may mean a delay of weeks or months."

It is necessary that the inventor, in seeking to provide a non-refillable bottle, should have a perfectly clear conception of every detail of the conditions which his invention is expected to meet. As the matter stands, it is difficult for him to tell just exactly what the requirements of the trade are. He is informed:

"First, that the present shape of bottles must not be materially changed.

"Another tells him that this is not a material objection, provided the result is accomplished.

"Second, if any liquid whatever may be introduced into the bottle it is fatal, as showing it may, in time, be refilled.

"Another says if it takes ten or twelve hours to refill it, it is practicable.

"Third, the cost must not exceed one cent.

"Another says five cents.

"Fourth, a perfect device in all respects is easily destroyed by boring the bottle, refilling it, and stopping up the hole, which may be readily concealed.

"Another says that is no objection, as it would be quite as readily discovered as though a different bottle were used. It would require an artist in the glass line to do it so cleverly as to avoid detection; and it is reasonable to suppose few, if any such, would be found in the business.

"Fifth, it must be impossible to extract the device from the bottle.

"Another says, provided the effort to extract it shall shatter the device so that its reinsertion, as a whole, is rendered impossible, such broken condition, or its utter absence, would be patent indication of the attempt or fact of refillment; especially after the public were aware that such a device had been adopted as part of the bottle."

It is pointed out that such contradiction is bewildering, and discourages invention at the very outset. The trade owes it to itself to "formulate certain qualifications," which may be easily recognized by inventors, and by which any new device shall be judged.

In regard to the change in the shape of the bottle, if it is the attractiveness of the particular bottle that sells the goods, the advantage gained does not warrant the change; but if it is the quality of the goods, it does.

If it will take not less than ten or twelve hours to refill a bottle, it is "practical as to that feature, because an appreciable percentage of substitution is occasioned by laziness," and the vast majority would give up the practice if it consumed so much time.

The cost of the non-refillable bottle should not be measured by that of the ordinary kind. If its cost be anything less than the cost of the present bottles, plus the present loss due to their refilling, it is practical in regard to this feature.

As against the statement that it would be an easy matter to bore a hole in the bottle, refill it, and seal it up again, it is urged that:

"The easiest way to convince one's self that this objection is an error is to take the necessary tools and bottles to any dealer, show him how to do it, and see how long it will be before he can do it so cleverly as to avoid ordinary observation. He would rather give up the practice of substitution. Now, whether such a hole were sealed with glass or by the paper label, it would be readily discoverable by agents; who, knowing that there was but one way to refill it, would always look carefully for such evidence; and, if found, it would be tangible evidence of the attempt at, or fact of, refillment."

The features which the trade demand as essential are summed up as follows:

First, the bottle must be made of a material that will in no way taint the liquid. This precludes metal, rubber, celluloid, leather, etc., and limits us practically to glass.

Second, its operative parts must be protected so that they may not be interfered with, or made inoperative by means of wire or other instruments.

Third, it must be impossible to refill the bottle by submersion, or by shaking it so as to disarrange its operative parts, or by forcing the liquid through the device by pressure within any reasonable time. Of course if it can be so constructed as to absolutely prevent the introduction of any liquid whatever by said means, it is most desirable; but if, on the other hand, it shall require such a length of time to successfully refill it as to preclude the probability of such attempts in the vast majority of cases, the device may be considered meritorious; but it remains for the trade to express itself on this point.

Fourth, the exit of the contents must be comparatively free and not seriously impeded.

A $2,350 Dog.

A record price for a dog was realized recently at the Birmingham Dog Show, at the customary sale by auction of dogs which had been claimed at catalogue price by two or more persons. Mr. R. S. Williamson's St. Bernard, Lord Hatherton, a young dog born in February last, which is said to be the best St. Bernard ever exhibited, was catalogued at $1,050, but, after a spirited bidding, the dog was disposed of for $2,350 to Mr. Joseph Royle, of Manchester.

THE suspension bridge at Niagara Falls is to be replaced with a steel arch bridge, wholly contained within itself, which will consist of a main arch span 840 feet long and two shore spans, that on the American side to be 190 feet long and the span on the Canadian side 210 feet in length. The arch span will consist of an open parabolic rib 26 feet in depth, with a rise of 105 feet at the center. The roadway will be 46 feet in the clear.

CHASE'S ELECTRIC CYCLORAMA.

Despite their artistic value and the great cleverness employed in their construction, the most beautiful panoramas have got beyond the limits of success. Ceding to the taste of the day, one has been converted into a circus, another into a skating rink and still another into a bicycle track.

The invention that we are about to describe in a general way seems destined, if the hopes of the inventor shall be justified, to bring panoramas into fashion again and to assure them, in the future, new success and a less ephemeral existence.

The idea of Mr. Chase, a resident of Chicago, who has been working several years in the improving of his apparatus, turns to account the most recent progress and discoveries in the way of panoramic photography, projection apparatus, electric lighting, kinetoscopes, kinematographs and all other systems that permit of faithfully representing the phenomena of motion and life, as well as landscapes and views of inanimate objects.

The possibility of causing a large number of views to pass before the spectator within a very limited space of time, and of imparting life to them at will, gives a cyclorama a true animation and a remarkable diversity that is absolutely lacking in ordinary panoramas.

Mr. Chase utilizes an ordinary panorama, but one in which the spectators stand upon the floor of a cylindrical chamber 100 feet in diameter and 30 in height, upon the walls of which are thrown photographs placed in a projection apparatus suspended from the center of the ceiling, after the manner of a chandelier.

In Fig. 1 we give a general view of the panorama as conceived by the inventor, and as it was realized upon a smaller scale in 1894, with experimental apparatus, at the Chicago Fire Cyclorama. Fig. 2 shows the projection apparatus in its entirety. Fig. 3 exhibits the mode of construction of the suspended platform upon which are situated the operator, the projection apparatus, their carriages and the electric lamps that light such apparatus.

It will be understood that nothing is more easy than to convert an ordinary panorama into an electric cyclorama. It suffices to paint the back canvas white and to suspend Mr. Chase's projection apparatus in the center of the hall.

The apparatus, suspended in the center of the panorama by a steel tube and guys of steel wire (Fig. 3), is 8 feet in diameter and 10 in height. The operator stands in the center upon a circular platform, and is surrounded by an annular table supporting eight carriages, upon which are mounted the projectors, lanterns, kinetoscopes, kinematographs and all the arrangements necessary for imparting life to the scene and producing the transformations.

Each projector is supplied by a special electric lamp, and the conducting wires that lead the current pass through the suspension tube. The annular table carries the commutators and the rheostats through which the light is regulated according to the effects to be produced.

The projectors are provided with iris diaphragms that permit of obtaining vanishing effects, and night, auroral or twilight ones. These projectors, eight in number, are double, thus permitting of the preparation of a view and focusing it while the spectators are looking at another. The change of pictures is not effected until everything is well regulated.

Very accurate regulations of the carriages that support the projectors permit of perfectly adjusting the views and of bringing them to a focus in order to obtain the continuity necessary for an illusion. The eight positive photographic views that produce a panorama 300 feet in circumference and over 30 in height are, together, about seven feet in length and eight inches in height.

The rays emanating from each of these projection apparatus are such that they would overlap, did not a frame fixed to the lenses and carefully regulated once for all suppress those parts of the views that would encroach one upon another without such precaution.

When the immovable panorama is well regulated, it is possible at will to animate such or such a part by projecting upon it, through processes already applied under other circumstances, moving clouds, moon light effects, ships in motion, naval battles, etc.

Upon combining this apparatus with the Edison kinetoscope or the Lumiere kinematograph, it would be possible to impart life to a street by projecting upon it the passing of a procession, the march of a regiment, etc. It was in August, 1894, that Mr. Chase made his first experiments at the Chicago Fire Cyclorama. A panoramic photograph 4 inches in height and 32 in length was projected cycloramically upon a circular screen 156 feet in circumference and 15 in height.

According to the Western Electrician, from which most of these details are borrowed, this preliminary experiment, although crude and not carried out in adequate proportions, much surprised and interested those whose privilege it was to be present thereat.

Fig. 3.—PLATFORM FOR THE OPERATOR AND PROJECTION APPARATUS SUSPENDED IN THE CENTER OF THE HALL.

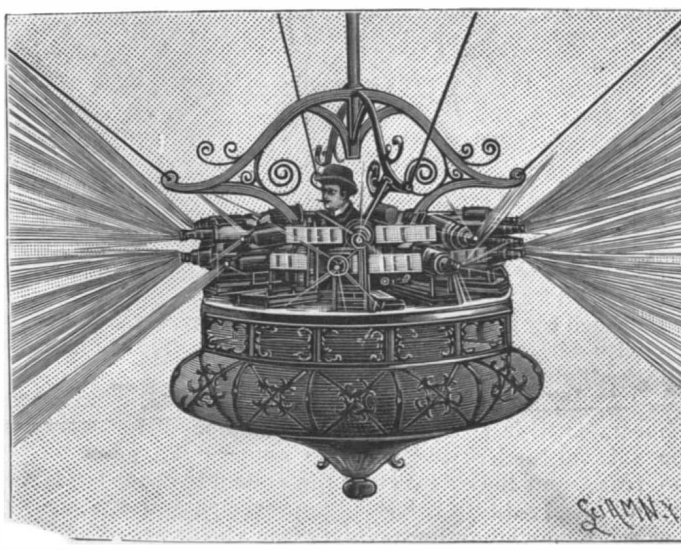


Fig. 2.—THE PROJECTION APPARATUS.

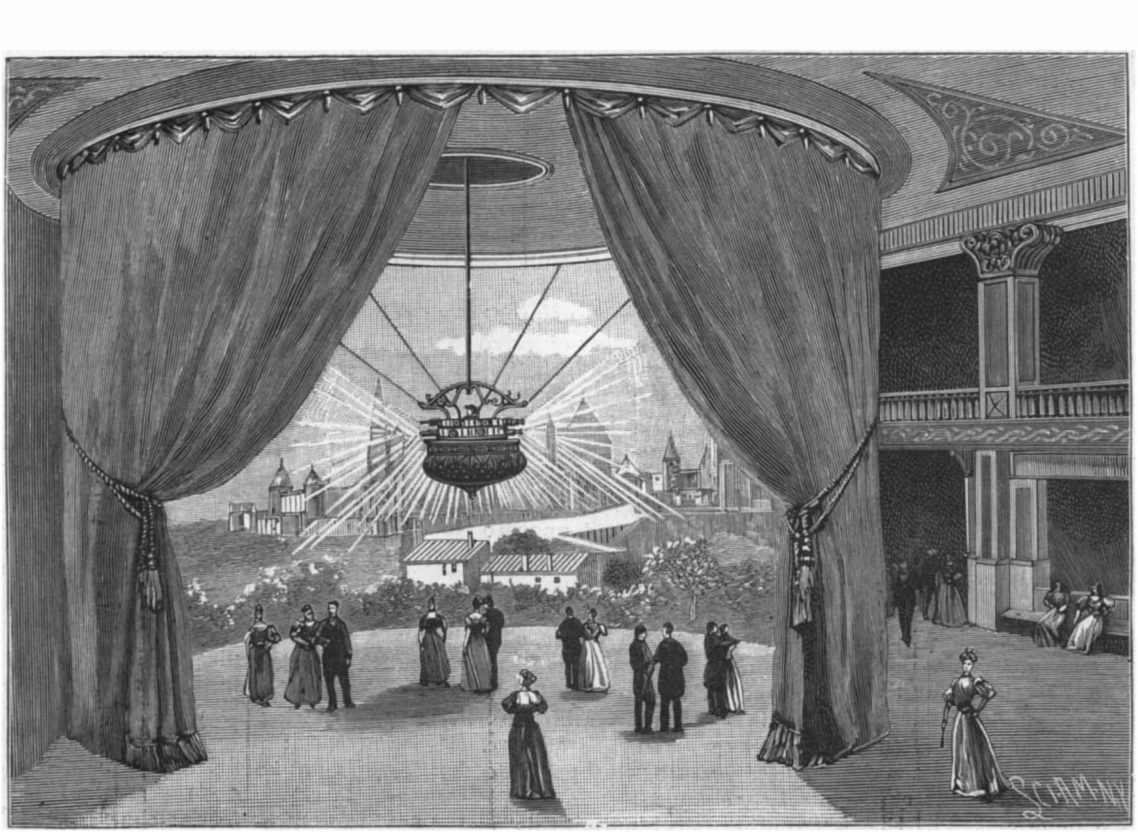


Fig. 1.—GENERAL VIEW OF THE CHASE ELECTRIC CYCLORAMA.

The Terrors of a First Night.

The Cornhill Magazine gives the following graphic account of the anxiety attending the introduction of a new play to a critical audience:

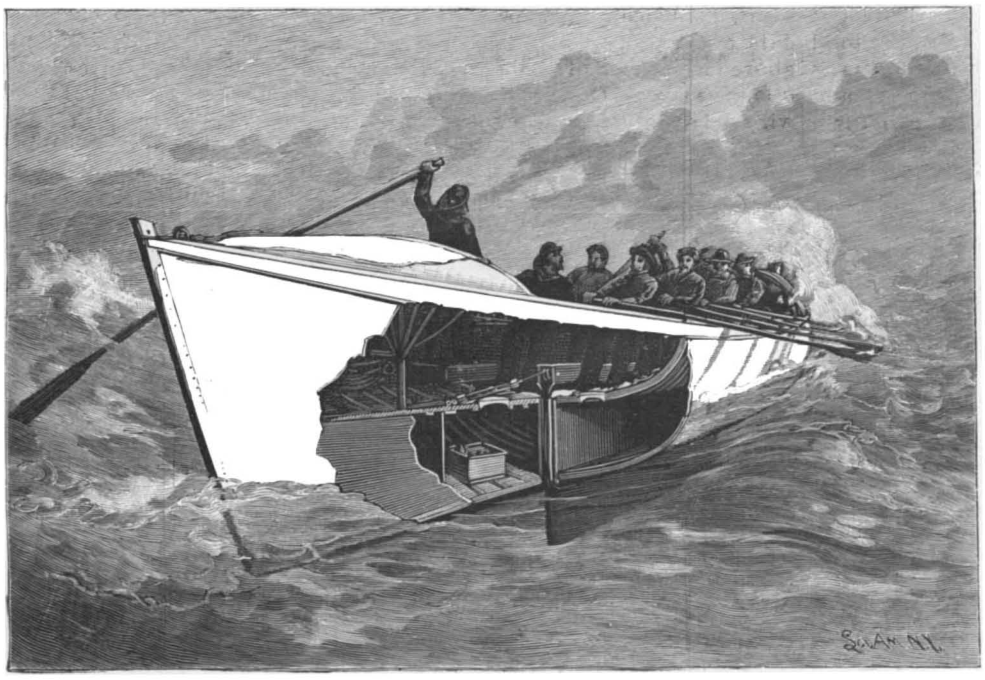
There is a passage outside our stage door, and there I go for a walk. It is perhaps fifty yards long, and up and down it I trudge like a convict taking exercise in a prison yard. The gallery door opens on to it, and higher up there is a slit for passing scenery through that looks down on to the stage. Some of the scene shifters stand there looking in; hot gusts of air and the voices of the actors rise up through it. But from the front of the house absolute silence; neither laughter nor applause, nor any sign of existence whatever. For any sound that rises, so far as I can judge at present, the third act might as well be played to empty benches. Up and down the passage I dolefully trudge, supported by one of the company who feels for my misery and apprehension. We talk gravely of everything but the piece; he tells me of his early career and struggles, and I listen sympathetically. I feel inclined to tell him something of mine, but conclude that after all he is seeing something of them for himself. Another joins us and observes solemnly, "I need scarcely tell you that your play depends entirely on its last act." I am much indebted to his penetration, I'm sure; I reply mournfully that I know that very well. Most plays do.

As the act draws to its close one or two people slink out of the gallery door. It's all over, I feel; let me go home and go to bed—let me try and forget I ever was mad enough to think the wretched thing was going to be a success. But my good friend takes me kindly by the arm and says that the act is ending, and we had better go down on to the stage. Exactly like the chief and most inconsolable mourner at a funeral, I go down the stone stairs and shuffle along the sloping side of the stage among people who make way for me, and at whom I dare not look. I feel a hundred years old, a broken man, that I shall never get over it. I go to my old place at the wing, and find there the master carpenter, who is smiling. Very strange, but even as I go to my place I am at once conscious of the presence of the old grateful fluid sympathy and interest I felt so strongly during the first act. There it is back again, making the footlights burn the brighter, vivifying as with a gas the whole scene. I know instinctively by its presence that the last act is all right—that it has more than pulled us through, though at present the applause has not begun. As the curtain falls and is raised again and again, the master carpenter bends forward and listens. "That's all right, sir," he says confidently. "I've seen so many first nights, and always know when the applause is genuine. That's all right, sir; you take my word for it." And so it seems, for the company are all called, and I am called. I have a vision as I bow of a house that seems all in white standing up and clapping. It looks to me somehow like Martin's picture of "The Plains of Heaven," with all the long rows of angels. The applause continues when the curtain is finally lowered, and some one from the gallery calls "Spee-eech!" No one responds to the invitation, and we are free to go home to bed, with the happy consciousness of having all of us scored a success—author and actors and even the master carpenter. As I go home across Trafalgar Square in the clear still night I cannot help thinking of the many pens scribbling away at that moment in the newspaper offices, nor can I keep myself from speculating, with a certain sickening apprehensiveness, as to what they are all going to say. That is one of the many trials and terrors of the theater—that your first nights are never over. There is the terror of the play itself—whether it is going to succeed or not with the audience; then comes the fear of the morning papers, and then the evening, and then the weeklies, each bringing its own particular load of apprehension.

DURING 1894, 3,315 patents relating to electricity were granted in Great Britain, the United States, and Germany. Of these 1,130 were British, being one-twentieth of all British patents, 1,704 were American, and 481 were German.

TAYLOR'S LIFEBOAT.

The lifeboat shown in the illustration is intended more especially in its construction and arrangements for storing provisions, water and clothing, to be carried for use in case a vessel has to be abandoned at sea. It has been patented by W. H. Taylor, of Narragansett Pier, R. I. The boat is divided for its entire length into two parts by the keel and centerboard box, the former of which extends from the bottom of the boat up to the second bottom or floor, the centerboard box extending still higher. By this division the boat, under the floor, is converted into two watertight compartments, which are filled with airtight metallic tanks, all of which, except the tanks at the ends, are provided with caps screwing into collars in the floor of the boat. These tanks are adapted to be used for provisions, water, clothing, etc., and if need be, on naval vessels, with ammunition. This boat may be launched in any shape, as she quickly frees herself of water through valves in the sides of the centerboard box, and is therefore self righting and baling. The tanks answer also for the purpose of keeping the boat from sinking, if it should get stove. The centerboard box is strengthened by castings held by bolts passed through the keel and by stay rods, while the metal centerboard, which is adapted to be readily raised and lowered, has vertical slots to correspond with the castings, making the entire construction very strong. The boat has been approved by the board of supervisors of steam vessels.



TAYLOR'S LIFEBOAT.

BAKU AND ITS OIL WELLS.

The accompanying engraving, for which we are indebted to Globus, gives us a very good idea of such a fire as sometimes occurs in the naphtha spring region near Baku. The danger of fire in this region is so great that every precaution is taken; smoking is prohibited, and the lamps used during night work are carefully closed, but in spite of all this there is an occasional conflagration. Some time ago a fountain of naphtha shot up suddenly, carrying with it many stones, which destroyed the electric lamps, and in a minute the whole column of naphtha, extending to the heavens, had taken fire. No earthly power can do anything to stop such a fire; water would only give fresh power to the flames. All day the clouds of thick, black smoke rose, covering everything in the neighborhood and making it seem like night, until the fire had devoured all that it could find to feed upon. The wooden planking over the excavations is covered with earth and sand to prevent such casualties.

The crude naphtha is carried from the reservoirs, the largest of which can hold 6,000,000 poods (216,000,000 pounds), in pipes to the "Black City," where we find a whole forest of smoking chimneys. The buildings, streets, trees, men and animals are covered with soot and smoke. The workshops and refineries extend far along the shore of the Caspian Sea.

The oil fields of which Baku has thus far been the principal center extend for a distance of 700 miles between the Black Sea and the Caspian, most of which has been but imperfectly explored, while only a small fraction of the known highly productive territory has been commercially worked. During 1894 the wells near Baku produced 38,000,000 barrels of oil, the production in the same year in the United States being 50,000,000 barrels. Besides this the production from other districts in Russia was considerable, the area of oil territory being officially estimated at 14,000 square miles. There are also many evidences of oil and natural gas strata beneath the Caspian Sea, to the east of which the territory is rich in ozokerite, or natural paraffin wax, which has within recent years found an important use as an insulator for electric wires.

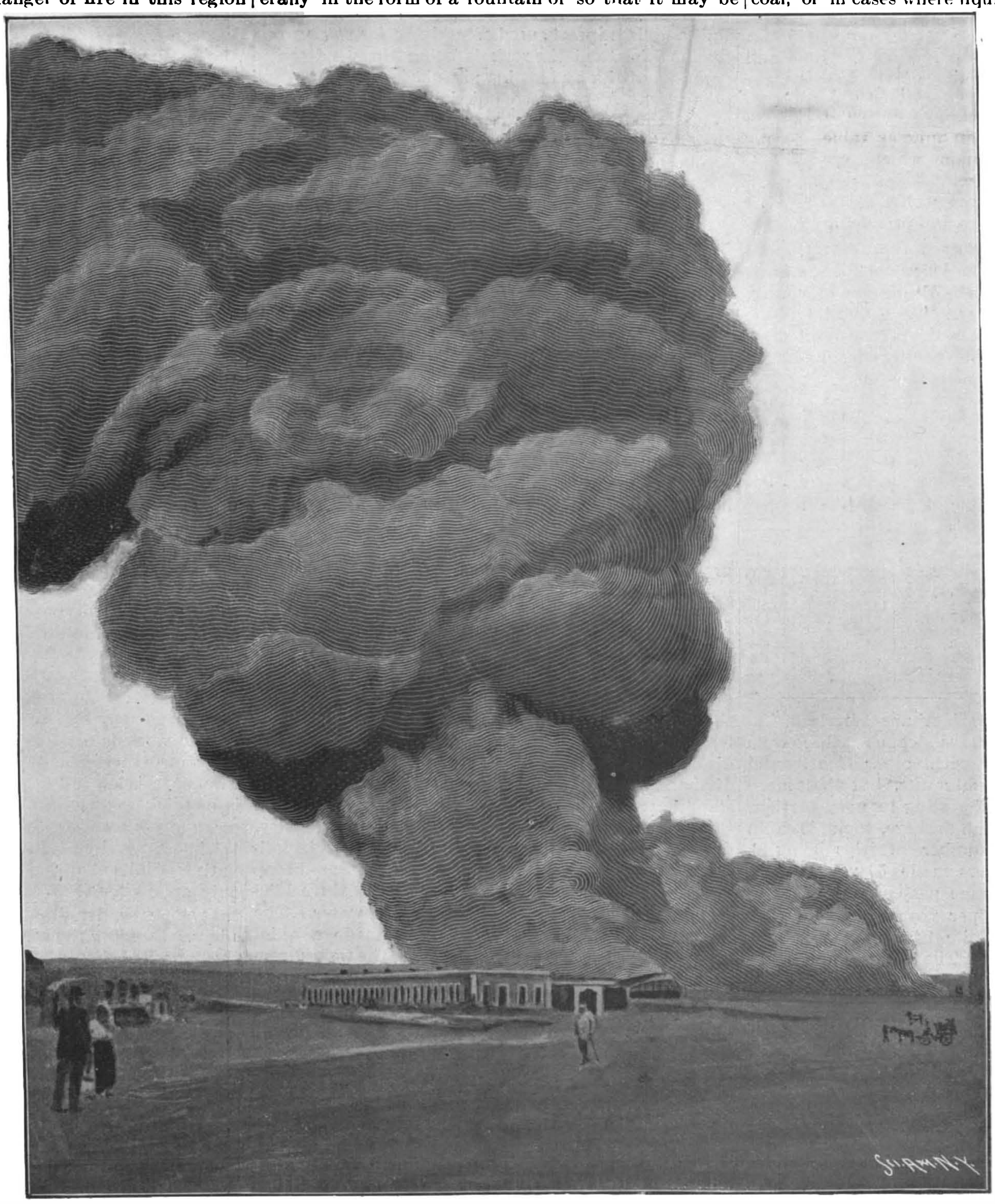
In the oil districts of Russia the wells yielding the most oil are all less than 800 feet deep, yielding oil generally in the form of a fountain or so that it may be baled out, and the wells are much larger, being sometimes of a surface diameter of 24 inches. The yield of some of these wells has been so enormous as to seem almost incredible. From one well sunk in 1886 the flow reached 2,750,000 gallons a day before it was controlled by the engineers, on the fifteenth day, and from the largest well yet known, sunk in 1893, the flow for the first few days exceeded 4,000,000 gallons per day.

The Russian oil differs largely from the American oil, the latter producing about twice as much kerosene or lamp oil as the Russian, while the Russian oil in ordinary lamps gives a smoky flame. This, however, may be corrected by lamps designed especially for its consumption, and affording a more perfect supply of air to the flame. The residuum of the stills is also well adapted as fuel. All the oil produced in the Baku region for foreign use has now to be transported by rail to Batoum on the Black Sea, a distance of about 400 miles, and with railway facilities none of the best.

The relative capacity of the Russian and American supply was touched upon in a recent number of the London Engineering as follows:

"Now that the adequacy of the Russian supply, in face of an evident falling off of the American production, has been shown, and the probability that ere long we must still further have to depend on Russia has been indicated, it is of importance to consider what steps should be taken by the Russian producers to render their oil more readily available to users in this country. For use as fuel, the Russian astatki—the residuum from their stills after distilling off the light naphtha, lamp oil, and lubricating oils—is sufficiently well known to insure its employment when sufficiently cheap to replace coal, or in cases where liquid fuel can be more readily used, but the principal field lies in the lamp oil, and the only means of insuring its use is the introduction of suitable lamps sufficiently easy to manage, and, above all, sufficiently low in price to bring them within the reach of the masses. Such an innovation is by no means impossible of realization. It was found possible in the sixties, when American petroleum commenced to displace the colza and other oils which were previously in use, and would probably be still more simple at the present time, when less prejudice has to be overcome.

"The perfect organization of the American producers has hitherto had the effect of securing to them the principal markets of the world, and it would be difficult to organize another trust having anything like the wealth and power enjoyed by the Standard Oil Company of America. Even they, however, cannot control the market in the face of a constantly falling supply of the raw material, and a well arranged attempt on the part of the Russians could scarcely fail to give them a largely increased outlet for their enormous supply. Even the agreement which has so often been reported as about to be signed between these great rivals would be by no means a false step on the part of either."



A FIRE AT THE NAPHTHA WELLS NEAR BAKU.

Transatlantic Passenger Traffic.

With steerage rates of 35s. to 42s. for the passage from this country to the States, and correspondingly low rates for the second class cabin berths, one would have expected a large accession to traffic in 1895. The official returns issued lately show an improvement on the abnormally low total of the previous year; but when comparison is made with normal years, the total of 96,558 cabin and 258,560 steerage passengers is found to be less in the one case by 25 per cent and in the other by 33 per cent. Five years ago there were 144,178 cabin and 371,593 steerage passengers, and in the following year—when the Chicago exhibition was open—the numbers were still higher, but since then the totals have dropped, although, as we have said, there was in 1895 an improvement of 4,000 cabin and 70,000 steerage passengers on the figures of 1894. We must, therefore, assume that the inducement of low rates has been counteracted by the stringency of the immigration laws, perhaps, also, by the less satisfactory views entertained as to labor prospects in the immediate future in the States. Even two years' figures, however, cannot be taken as indicating any trend, and we must, therefore, confine our consideration to the steamship working. The reduction in passengers is mostly from the Continent, for the companies who have experienced distinct decreases are chiefly those sending ships occasionally from different ports. The regular liners have not suffered to the same extent. The withdrawal of the occasional emigrant steamer is shown by the fact that only 792 trips were made to New York in 1895, as compared with 879 in 1894 and 975 in 1893. Thus the number of cabin passengers per steamer last year was 122, as against 105 and 125 in the two previous years, while the number of steerage passengers per ship was 326, as against 214 and 374.

The revenue per ship might have been almost the same as two years ago had not rate cutting operated to the contrary. As to the relative positions of Liverpool and Southampton, the latter has increased its total cabin passengers from 35,203 in 1894 to 37,494 in 1895, due solely to the gain of the American Line. Liverpool has practically remained stationary, the cabin total of the Mersey ships for 1895 being 30,649. Of course the Southampton steamers include the few cabin passengers from Bremen and Hamburg. Both ports experienced a decrease on the figures of 1893, but the Liverpool recovery is less pronounced. Time and again it has been pointed out that the new steamer has the preference, and this is partly the reason why the American Line, with their new St. Paul and St. Louis, have increased their total in greater proportion than any other line, 2,586 cabin and 3,675 steerage passengers having been carried in excess of the total of 1894. They come within 2,700 cabin passengers of the Cunard total, although they have six trips less; and again, it should be remembered that four Cunard steamers are engaged for three American liners, a great difference in respect of capital. Each line, of course, must have a stand-by steamer. The Cunard top the list again, with the American next, and the White Star third; but figures will be more readily consulted if we tabulate the totals of the principal lines:

Line.	1893.		1894.		1895.	
	Cabin.	Steerage.	Cabin.	Steerage.	Cabin.	Steerage.
Cunard	18.462	25,103	18,362	19,175	18,844	21,724
American	14,374	12,100	13.560	15,905	16,146	19,580
White Star	13,327	28,876	11,520	20,898	11,805	30,725
North German Lloyd	15,930	68,465	12,049	19,927	10,895	44,326
Hamburg-American	13,052	33.091	9,594	18.463	10,543	30,141
French (Havre)	10,205	16,559	7,490	9,589	7,587	16,469
Anchor (Glasgow)	8,510	11,546	5,703	6,437	6,604	10,011
Red Star (Antwerp)	7,015	24,483	4,513	8,609	4,890	12,554
Netherlands (Rotterdam)	6,033	27,381	3,316	9,638	2,855	11,416
Allan State	3,459	10,298	2,322	2,909	2,509	3, 12

The North German Lloyd, Hamburg-American, Cunard and Anchor Lines all have steamers sailing from the Mediterranean, which, with other Continental lines, bring up the total of emigrants, but these need not be referred to. It is interesting to note, further, that the Cunard ships, on an average, took 336 cabin and 388 steerage, the total number of trips being 56. The American Line steamers made 50 voyages and took 323 cabin and 392 steerage passengers each trip. This is 40 cabin passengers per voyage more than in the previous year. The White Star took 231 cabin and 602 steerage passengers. The latter company has always had a large company of emigrants in their ships, as the table suggests. The French steamers made 54 voyages, taking 140 cabin and 305 steerage passengers per ship; and the Hamburg-American 93 voyages, taking 113 cabin and 324 steerage passengers; and the North German Lloyd 130 voyages, the averages being 83 and 341 respectively. But in the last two instances it should be stated that intermediate steamers are frequently sent carrying only emigrants, so that while the number of emigrants per ship compares favorably with British ships, the number of cabin passengers is necessarily less. Of cabin passengers 40 per cent were carried by British-owned steamers and 60 per cent of the emigrants.—Engineering.

The New East River Bridge.

Chief Engineer L. L. Buck, of the new East River Bridge Commission, has forwarded to the War Department, at Washington, for approval the preliminary data of the proposed bridge, showing the clear height above mean tide and the encroachment of the piers upon the river. On the Williamsburg side the bridge will land about two blocks above the present Broadway Ferry house, and on the New York side the approach will be between Broome and Delancey Streets. Mr. Buck's report to the commissioners, which was adopted on January 29, favors a six track bridge, with two elevated tracks in the middle and two trolley tracks on either side. The total width is to be 118 feet, and to accommodate the roadway and walks it will be necessary to place them over the railways instead of on the outside of the trusses, as originally proposed. Mr. Buck thinks this can be done without exceeding a live load of 10,000 pounds per linear foot, but he will raise this amount by 20 per cent to provide for future contingencies. The scheme contemplates a loop terminal at each end for the car lines.

It is suggested that the park commissioners and other interested parties be requested to "co-operate in the removal of all buildings for the length of the bridge approaches, for the purpose of making small parks of the land not occupied by these approaches."

It is calculated, as regards the trolley lines, to run the cars across the bridge singly or in trains made up of a motor car followed by three or four trailers.

As soon as the general plans sent to the war office have been approved, the full working details of the bridge will be prepared.

Preservation of the Palisades.

The most magnificent piece of natural scenery near New York is the Palisades of the Hudson River. For a distance of fourteen miles, the river is bordered on its west bank by a wall of solid rock varying from 250 to 550 feet in height, to which the name Palisades has long been applied. The cliffs rise from a narrow shore at the river's edge, and from their summit the ground gradually descends to the westward toward the valley of the Hackensack. The material of the Palisades is traprock, used extensively for paving and road making, and the rock is being thrown down in great quantities by blasting; is sold for municipal and other uses. A special commission has been appointed to propose measures to prevent the destruction of the great cliffs, and, as a result of their efforts, a bill has been presented in the House of Representatives authorizing the purchase by the Federal government of ten thousand acres of land along the edge of the Palisades, and corresponding bills have been passed by the legislatures of the States of New York and New Jersey, ceding the jurisdiction over this ground to the United States government.

In preserving the Palisades, the Federal government will merely perform another act in its character of preserver of objects of national interest, such as the Yellowstone National Park, Gettysburg and other battle fields of the civil war. The region along the edge of the mighty cliffs can be made a park of surpassing beauty. At Niagara Falls there is a State reservation on the American side and a correspondingly protected portion held by the Canadian government on the Canadian shores to protect the Falls from injury.

As regards practical availability of the region, it is provided that it shall be open to the use of the State militias of New York and of New Jersey.

Soapsuds on the Waves.

Some experiments have recently been made, says Railroad Gazette, which show that soapsuds will reduce a sea almost as well as oil. This was first tried on the Scandia, an English steamer, in a storm on the Atlantic. Having no great quantity of oil, the master dissolved a large quantity of soap in water, which was discharged over the bow. The effect was nearly instantaneous, the height of waves being so diminished that the vessel could be managed without difficulty. Captain Le Gall, of the French steamer Sénégal, sailing the Adriatic, was struck by a squall and used soap and water with same result. He used three kilogrammes of soap dissolved in 70 liters of water. The solution when dripped over the bow made a quiet space about 10 meters wide, preventing the waves from breaking over the vessel.

A CONTEMPORARY makes the statement that the greatest corporation on earth is the London and Northwestern Railway Company, of England. It has a capital of $595,000,000 and a revenue of $6,500 an hour; has 2,300 engines, and employs 60,000 men. Everything is made by the company—bridges, engines, rails, carriages, wagons, and an innumerable lot of other things; even the coal scuttles and wooden limbs for the injured of its staff. Repairs to the permanent way cost $130,000 a month.

Prof. Herkomer's New Art.

On the afternoon of January 28, at the rooms of the Fine Art Society, in London, Prof. Herkomer, R.A., gave a demonstration and explanation of his "New Black and White Art," says the Evening Post. Prof. Herkomer spoke as follows:

The black and white art, which I now present to painter and public, is new from nearly all points of view. It is patented under the definition of "an improvement in artistic printing surfaces," and not the least part of the novelty lies in the fact that this "printing surface" is the result of a peculiar treatment of an artist's painted handiwork. Thus, probably for the first time, the painter has it in his power to do black and white work, diffusible by the printing press, without departing from his accustomed methods of work, for I give him "paint" to manipulate with the "brush." He has no new technicalities to acquire, such as are needed for the production of various forms of engraving—technicalities that have hindered many an artist from taking to "plate work." I will describe the working of this new invention.

First, then, on the polished surface of a copper plate, which is coated with silver, the artist paints his picture with a thick black pigment resembling printer's ink. In the production of this painting he uses brushes, leathers, stumps, dabbers, pointed bits of wood, his finger tip, or anything, in fact, that will enable him to get the desired effect. So far, you will note, it is a positive process, requiring, therefore, no reversion of the subject on the plate—an inestimable boon to the artist. Although the further development of the process requires that the ink shall remain wet, the artist need in no way hurry himself, as the ink I have invented for this method of work practically never dries. But I rather think the artist will rely on rapidity of work for success, as he will find response to the touch so very perfect. On examination of the painted plate, it will be seen that the ink is on the surface in different degrees of thickness. In this variety of depth in the ink lies the first vital point of the invention. The artist need in no way think of this necessary condition; it comes without conscious effort in the making of his tones and gradations.

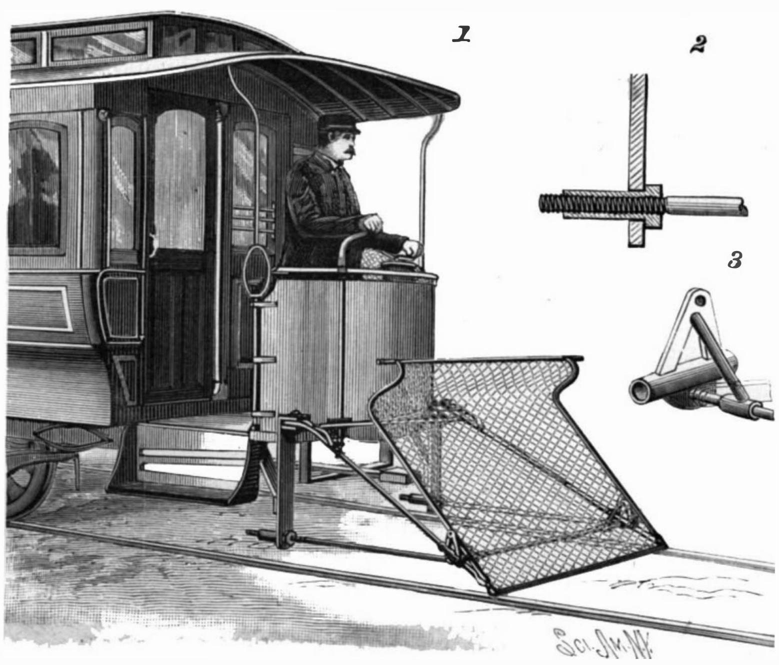
This printed surface, with the ink still wet, or soft, is now dusted over with a particular powder—dusted thickly until neither the black paint nor the brighter parts of the plate are visible. A knock on the back of the plate will cause much of the superfluous powder to fall off, but by no means enough. Therefore, a soft, broad, camel hair brush has to be used to brush the surface gently and in all directions, until no more powder comes off. As this powder contains both coarse and fine particles, it will be found that it has stuck to the various parts in the most discriminative way—that is, the coarser grain has adhered to the parts where the ink happened to be thick, and the finer where the ink was less, such as in the gray or light tones. The importance of this discrimination cannot be overestimated, as it affects so materially the quality of the printing surface. We have now, at this stage, a painted picture dusted with a powder which granulates the painted touches in perfect proportion to their depth of tone, without, however, in any way altering their autographic character. But it causes the paint to cover new technical ground, and is the first stepping stone toward the conversion of the painted surface into a printing surface. I may mention that the ink used is composed of German black and a mineral oil, and that the powder is composed of an inert and an active ingredient—the one to give granulation and the other conductibility.

We now enter the third stage and take of this granulated surface a "metallic mould," or, in other words, an electrotype. Such is the conductibility of this surface that (all things being right) in ten minutes a blush of copper spreads over the whole surface when subjected to the electric bath. This settles in and repeats the most minute crevices and interstices. The electric current and quality of the bath for this particular work is a matter of careful experiment, but when once successful, is absolutely certain in its action. The plate is left in the bath until the copper deposit is as thick as an ordinary printing plate, which may mean anything from six to ten days, according to the thickness required. In taking the plate out of the bath it will be seen that the deposit of copper has not only gone over the edges of the original plate, but that the new, deposited plate is thickest nearest the edges. By filing the edges we are enabled to separate the deposited from the original painted plate, and in the deposited plate we get an exact negative or mould of the painted and powdered surface, from which, by the ordinary methods of copperplate printing, a perfect reproduction of the original painting is obtained. That is the process.

THE sum of $22,500 has been subscribed toward defraying the expenses of the meeting of the British Association at Toronto, Canada, in 1897. Ten thousand dollars is contributed by the Dominion government; $7,500 by the Provincial government and $5,000 by the city of Toronto.

AN EFFICIENT CAR FENDER.

The illustration represents a fender designed to pick up, without danger to life or limb, a person caught in the path of a moving car to which the improvement has been applied. It has been patented by Charles A. L. Du Quesnay (address in care of Canal Bank), New Orleans, La. Two braced standards are attached to each end of the car, the upper end of each standard having ears with vertical pin apertures and its lower end having a rod-receiving aperture. The side bars of an open frame are connected by pins to the upper ends of the standards, and on the lower portions of the side bars are rigidly connected sleeves on which are upper and lower lugs, as shown in Fig. 3, the upper lugs being connected to the lower cross bar of the frame by braces. Pivoted at their front ends to the lower lugs are longitudinal brace rods, whose rear ends are threaded and adjustable by means of sleeve-like nuts, as shown in Fig. 2, in the apertures in the lower ends of the standards, and the front end of the fender frame may be raised or lowered in relation to the roadbed by the adjustment of these nuts. The fender proper, covered with netting, is pivoted near the lower ends of its side bars to the lugs or ears near the front ends of the side bars of the other or supporting frame, spiral springs holding the front end of the fender low down. The rear end of the fender is bent to form a pillow or cushion when struck by the head and shoulders of a person falling upon it, the fender then swinging back upon its pivotal support, and stop extensions of the rear fender bar resting upon cushioning springs on the side bars of the supporting frame. Across the front end of the fender is a flexible strand of solid round rubber, to prevent injury to the limbs of any one struck thereby, the fender being tilted to horizontal position as a body falls upon it, thus raising the front end of the fender high enough to prevent the dragging of a person's feet.



DU QUESNAY'S CAR FENDER.

CURIOUS COLLAPSE OF A BAROMETER.

The highest velocity of the wind and the lowest barometer on record in New York City, for twenty-one years, both occurred during the great storm of Thursday, February 6. As recorded by Mr. Dunn at the local Weather Bureau station, the wind varied between 64 and 72 miles per hour, and it rose at times as high as 80 miles during the fiercer gusts.

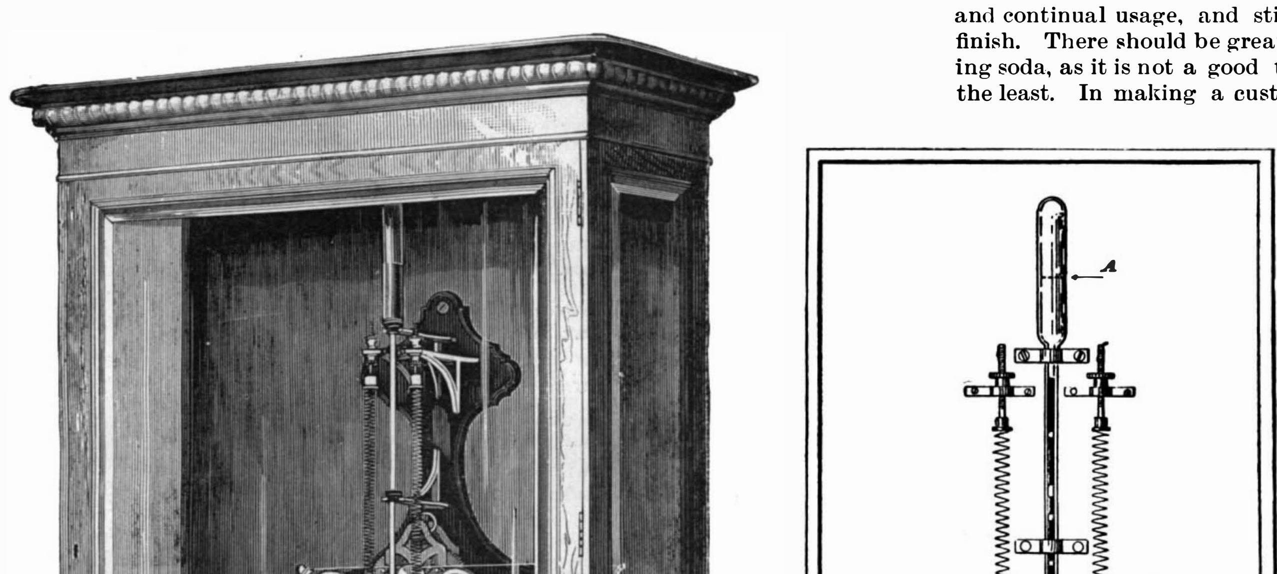
The phenomenal fall in barometric pressure was made memorable in the office of the SCIENTIFIC AMERICAN by the collapse of its self-recording barometer—a fine instrument, made by the Draper Manufacturing Company, of this city. Among the many cards taken from this instrument during the nine years that it has done continuous duty, there is only one which shows any approach to the reading of February 6. The card for February 8 of the preceding year shows a reading of 28·60; the instrument at the time of its collapse on Thursday, the 6th inst., recording 28·57.

The lowest record at the Central Park Observatory for the past thirty years is 28·42, which was taken at 9 P. M. on February 5, 1876. The occurrence of these lowest barometers on almost identical dates, viz., the 5th, 6th and 8th of February, is noteworthy. The reading, as taken by Mr. Dunn at the down-town observatory, was 28·80; at the Draper Manufacturing Company's office, 152 Front Street, 28·66; at the SCIENTIFIC AMERICAN Company's office, 28·57; at the New York Herald office, 28·55; and at the Central Park Observatory, 28·60. Dr. Draper, of the latter observatory, states that, considering the cyclonic nature of the storm, these readings show a fairly close approximation. Local influences and the vertical oscillations of the barometer in a storm of this intensity produce variations between the readings of different instruments in any one city. Two barometers placed one on the windward and one on the leeward side of a large building would vary in readings, for the reason that on the windward side there would be an increase of pressure resulting from the banking up of the atmosphere by the resistance of the building, and there would be a decrease of pressure on the leeward side resulting from the partial vacuum caused by suction.

We present a cut showing the general features of the barometer in our office and the causes which led to its collapse. It consists of a glass tube about three feet in length, which is rigidly fixed in a vertical position and is provided with an enlarged receiver at its upper end. This tube is filled with mercury, and its lower end, which is open, dips into a tube or reservoir containing the same metal. This reservoir is suspended on two spiral steel springs and has freedom of vertical motion. When the pressure of the atmosphere diminishes, a portion of the mercury flows out of the tube into the reservoir, and this, becoming heavier by that amount, stretches the springs and falls a proportionate distance.

An increase in atmospheric pressure will force a certain amount of mercury out of the reservoir into the tube; and the former will rise proportionately. The fluctuations are marked on a chart by an ink pencil attached to the reservoir. The normal height of the mercury in the tube and reservoir is shown by dotted lines A, A′. In the storm of the 6th inst. the outflow of mercury was so great that the top of the reservoir was carried below the bottom of the fixed tube, as shown in the accompanying cut. At the moment when the contact between the tube and reservoir was broken there was a rush of air to fill the vacuum in the upper bulb of the tube, and this was so great that a portion of the mercury was thrown violently against the top of the tube, breaking it completely off, and letting the mercury drain out of the tube. A similar accident happened to the barometer at the New York Herald office in this city, except that the great fineness of the tube in this case prevented a rush of air and mercury sufficiently powerful to fracture the upper bulb.

The range of these very fine instruments was based upon 30 years' readings, and it was reasonably supposed to cover any possible variations from the normal barometer of 29·96 for this locality.



SCIENTIFIC AMERICAN SELF-REGISTERING BAROMETER BROKEN BY ATMOSPHERIC DEPRESSION ON FEB. 6, 1896.

How Harness Makers Work Leather.

"Place your leather in clean water until it is dampened two-thirds the way through," says Harness. "Then take a piece of burlap and wet it. Wrap the stock in this for six hours, or over night. This process does not soak the leather with water, but simply puts it in a mellow condition, from which it will retain the crease and finish. When taking your leather from the cloth in which it is wrapped, take only that which you can work before it will dry out. You will then take off the top edges (if they are to be taken off), then crease your stock and take off the bottom edges. After this is done lay the stock out on a bench to dry. After it is thoroughly dry, apply a weak solution of sal soda (only strong enough to cut the grease). This may be done with a sponge. Apply the blacking with a stiff brush, rubbing it well. After it has remained in this state for ten minutes, you will give the flesh a coat of tallow (rubbed in well with the hand). After it has remained in this state over night, you will then take a glass slicker and go over each strap with the flesh side up. After this is done, take a coarse piece of cloth and wipe until clear of grease. Leather prepared and finished in this manner will stand the test of water and continual usage, and still retain the crease and finish. There should be great caution used in applying soda, as it is not a good thing for leather, to say the least. In making a custom job I would recommend glass for cleaning the flesh of leather. Leather to be used for folds should be taken down to the desired thickness while the leather is dry, as you will be less liable to spoil them while drawing them through the splitting machine. No strap should ever be creased while it is dry, for leather that is creased while dry will not have a crease on it after it has been used for a short time."

Humidity in Dwellings.

It being granted that humidity in dwellings is the cause of many diseases, the following simple method of testing, which has been suggested by the Lyon Medical, is interesting. It directs that doors and windows of the room must be closed to prevent the entrance of exterior air and that a piece of fresh quicklime should be left in the room for twenty-four hours. It claims that in an ordinary room, if three-quarters of an ounce of water is absorbed by the lime, the room may be considered unhealthy. The amount absorbed is determined, of course, by weighing the lime. Our authority, unfortunately, fails to state the size of the room.

RECENTLY PATENTED INVENTIONS.

Engineering.

REFINING ZINC.—George M. Holstein and John D. James, Pulaski City, Va. A process of and apparatus for refining zinc spelter and separating therefrom the lead, patented by these inventors, is based on the specific gravity, the melting points, and the volatilizing points of the two metals, and provides therefor special furnaces and retorts. The furnace fires are designed to be so regulated as to keep the retorts as nearly as possible at the temperature at which zinc volatilizes, lead requiring a slightly greater heat to volatilize, and the lead in melting collecting at the lower part of the retort, this part of the retort being exposed to the air, which chills the metal and diminishes ebullition. The volatilized zinc passes over a bridge into a condenser.

ZINC REFINING FURNACE.—George M. Holstein, Pulaski City, Va. For better carrying out the above process this invention provides a furnace designed to save fuel, the front ends of the retorts being made lower than their back ends, to cause the lead to flow to the front, where there is an externally exposed dam, the molten metal flowing out only through a tap hole, and the condensers being arranged to open only in the top part of the front ends of the retort. All the operations are conducted from the front, and the lead may be drawn off from time to time without stopping thefurnace. Zinc dross, galvanizers' waste, or other forms of zinc or zinc trimmings may be treated in the furnace.

Railway Appliances.

CAR FENDER.—John F. Girtler, Brooklyn, N. Y. In this device a main frame, which may be readily applied to and removed from the dashboard, supports a swinging platform adapted to rock forward and rearward, a spring-pressed guard being normally locked in place by the platform. When a person is struck by the moving car, and falls back upon the platform, a guard frame is swung up by springs, to prevent the person falling out of the fender. The entire fender may be readily swung up into folded position.

CAR FENDER AND BRAKE.—George W. Beard, Baltimore, Md. This fender is located entirely beneath the car platform, the front edge of which is cushioned by a hollow elastic tube, and the fender has a front or tripping frame, which, on coming into contact with an obstruction in the path of a moving car, adjusts the fender in position to catch and retain a person caught. The fender is also pivoted to a vertically movable frame provided with brake shoes, the fender and brake being automatically lowered by the action of the tripping frame, although they may be lowered at will by pressure upon a treadle on the car platform.

CAR DOOR.—John J. Mulligan, Vicksburg, Miss. This invention provides a light and water proof freight car door, preferably made of metal, which may be conveniently slid over the door opening to closed position, the door being guided and having only a sliding movement, while it is provided with a lock and automatically locks itself when closed.

CAR WINDOW VENTILATOR.—Charles Whitlow, Washington, D. C. This is a device which may be readily applied to or removed from either end of a window, and so adjusted as to admit air in any desired quantity, the incoming air being protected by external hoods. The device may be compactly stored when not in use, and has independently adjustable ventilating sections so guarded as to avoid excessive draught upon the rear section of the ventilator.

RAILWAY FROG.—Edward N. Grigware, Caseville, Mich. This invention relates to devices for shifting or setting the frog similarly to the tongue of the switch, that the joint between the main line rails and siding may be closed as completely as possible. Pivoted to a base plate attachable to the rails is a frog having its opposite ends adjacent to the rails, sheet metal stops with bent up central portions being secured to the base plate on opposite sides of the frog. The device is simple and inexpensive, and the parts are not liable to become deranged or broken by hard usage.

FISH PLATE LOCK.—Albert E. Trentowsky, St. John, Canada. This is an improvement whereby one of a pair of fish plates is provided with lengthwise keyhole slots to receive the bolts that attach it to the rails, being locked in place when engaged by the bolts by a removable device. The locking device consists of a curved spring having a portion which engages the bolts and another portion which engages the wall of the slot, a prong or finger of the spring entering the slot and engaging the slidable splice.

Electrical.

TELEPHONE SYSTEM.—Wallace A. Houts, Parker, South Dakota. A call box is provided with a revoluble wheel and a revoluble indicator, according to this improvement, a spring having its ends secured to the wheel and the indicator being wound up by the rotation of the indicator relatively to the wheel, the wheel operating a circuit-breaking mechanism. The improvement is designed to diminish the employes of a central office, and provide a simple and efficient call box and automatic switch, whereby any call box may be operated to work the switch and connect one telephone with any other of the series in the system.

BATTERY.—Charles J. Hirlimann, Fort Lee, N. J. The jar of this battery has interior flanges, and the zinc element extends around the interior of the jar, while the carbon element comprises two cup portions having perforated walls, there being a flange on the upper portion of the carbon element adapted to rest on the flanges in the jar, and there being two ears on the carbon element to which line wires may be connected. The carbon element presents a large surface to the action of the exciting medium, presenting practically a two-cell battery in one jar no larger than the ordinary single cell jar.

FUSE HOLDER AND LIGHTNING ARRESTER.—Harry A. Lewis, Norristown, Pa. This is an improvement in devices for automatically cutting out the line of an electric circuit when the current is excessively increased. A fusible wire is made to form part of the line, this wire being designed to be burned out with too great current, and the invention provides means for easily inserting and removing the fuse block and an automatic device for grounding the excessive current, the improvement embracing two slotted binding posts in the slots of which are spring-clamping devices, a fusible wire connecting the posts.

ELECTRIC RAILWAY.—August Casazza, Hoboken, N. J. This invention is for a conduit line road in which the line wire is made up of a series of independent insulated sections, an automatic switch bringing the several line sections in and out of the circuit as the car passes along the track, so that the line wire is practically dead and harmless. The switches are operated by an independent local circuit, preferably energized by a storage battery on the car, so that they may be worked without reference to the line circuit, the entire system being designed to be certain of operation, durable, and little likely to get out of repair.

SIGNALING AND SWITCHING.—John D. Taylor, Chillicothe, Ohio. This is in part an improvement upon a former patented invention of the same inventor, providing improved mechanism for operating the rail switch, arranging the circuits so that an accidental cross will not lead the current to a switch or signal where it is not wanted, providing for reversing the switch-operating motor to avert the possibility of failure of arrest of its operation at the right point, and reducing the number of wires to operate a switch and signal plant.

Mechanical.

PAPER MAKING MACHINERY.—Alfred H. Smith, Wilmington, Del. This invention provides an improved guide for the felts and wires of paper-making machines, comprising reciprocally balanced rollers adjacent to the guide roller and connected with its sliding bearing, the auxiliary rollers receiving the sides of the felt or wire, so that on the oblique travel of the latter either roller is overbalanced, and the bearing is shifted to change the position of the guide roller to correct the movement of the traveling wire or felt. The improvement affords a very sensitive apparatus to correct the tendency of the felt or wire to run to one side.

DISTRIBUTING GEAR.—James T. F. Conti, Paris, France. For controlling the supply of steam, compressed air, etc., in operating accessory apparatus simultaneously with the action in the motor cylinder, this invention provides a series of valves arranged in circular series and provided with segments, a lever mechanism comprising a segmental arm being movable into engagement with the several valve segments, and there being means for imparting a rotary movement to the arm, and a stop to prevent its complete rotation.

ELEVATOR POWER WHEEL.—George S. Fouts, San Jose, Cal. This invention is an improvement on a former patented invention of the same inventor, and comprises a revolving drive wheel pulley having movable clamping sections operated by cam surfaces normally held from turning with the wheel, the cam surfaces being capable of a partial revolution, and being adapted to be set to release the clamping sections at different portions of the circumference of the pulley.

Agricultural.

CULTIVATOR.—Harm H. Franzen and Rudolph Haschemeyer, Golden, Ill. This is a machine which, in addition to the beam and cultivator blades, has an auxiliary cultivator rotatably mounted and driven by contact with the ground, being attached to the beam in a manner to pass between the hills. The ordinary cultivating blades operate in the usual manner as the machine advances, cultivating the ground at each side of a row of hills, while the other or weeding cultivator cultivates the ground crosswise adjacent to each plant to eradicate all weeds, it being designed to cultivate a field at one passage of the machine.

TRANSPLANTER.—Joseph S. Ober, Ridgeley, Md. This is a pneumatic device, in which a transplanting cylindrical shell, with sharpened lower edge, adapted to be forced down around and over the plant, is connected with and forms a part of an air pump, the pulling up of the piston of which forms a partial vacuum to assist in withdrawing the plant from the earth, while the forcing down of the piston compresses the air and tends to force the plant from the shell without injury to its foliage.

Miscellaneous.

BICYCLE AIR PUMP.—Willis H. Ostrander, Boston, Mass. This is a pump which cannot be detached from the bicycle, its barrel being formed of one of the tubular brace bars of the frame, while the piston rod is guided at its upper end in a branch of a hollow saddle post, the operating handle being arranged to lie normally below the saddle. An elastic tube, normally held along the brace bar, is connected with the discharge end of the pump, and has at its outer end a nipple adapted to be inserted in the air valve of the tire.

STREET CLEANING MACHINE.—Clinton Beckwith, Herkimer, N. Y. This is a machine to be operated by power for simultaneously sprinkling the street, taking up and removing the dirt, disinfecting it, and discharging it at intervals. The machine has an inclined elevator or carrier trunk or casing whose lower end has a rearwardly diverging mouth into which is discharged an air blast and aqueous spray through a wide spreading nozzle impinging against the road bed, the same blast also blowing a disinfectant into the trash. The air blast may be used either with the water spray and disinfectant or alone.

TURPENTINE HACK.—Edward Blount, Quitman, Ga. This is a tool of scoop-like shape with curved cutting edges for making the requisite cuts in trees, and the tool is formed, according to this improvement, with a shank which permits its ready attachment to and removal from the handle. The hack is thus made reversible, so that one edge can be used after the other, and less frequent sharpening will be required.

BALL FOUNTAIN PEN.—Sirus E. Kochendarfer, Hollidaysburg, Pa. This is a tubular marker or pen for marking boxes or packages, the cap at one end of the tube holding the marking fluid having a drawn-in flange within which fits an outwardly projecting ball, against which bears a spring-actuated presser. An annular pad held by the presser prevents the too free passage of the marking fluid to the sphere, which forms the marking device, and yet permits the pressure upon the sphere to regulate the amount of marking fluid supplied.

ALBUM.—Felix Reifschneider, Brooklyn, N. Y. This invention relates especially to photograph albums which have removable leaves, and provides for the leaves lying flat when the album is opened. Inexpensive and durable devices are also provided for removably securing the leaves in the binding, whereby one or more of the leaves, or all of them, may be readily placed in position in the album or removed therefrom.

PERFUMING DEVICE.—Frederick G. Fisher, Battle Creek, Mich. For perfuming and scenting the air of rooms, this invention provides a simple and inexpensive mechanism for utilizing the perfume in the most economical manner, the perfume being held in a pivotally mounted receptacle from which it is discharged in a continuous and regulated manner, according to the adjustment, by a specially arranged clock mechanism. The perfuming device may be constructed as a separate instrument, but is preferably embodied in a time piece.

BINDING FOR BOOKS.—Carl A. Evertz, Brooklyn, N. Y. This is a binding especially designed for employment upon heavy sheets or leaves, such as the thickened leaves of sample books, albums, scrap books, etc., the leaves being provided at the bound edge with a reinforce or hinge strip of cloth or similar material, and the reinforce being attached to the next adjacent leaf or sheet, to dispense with the sewing or kerfing.

BALE TIE FASTENER.—Edmund A. Jablonsky, Brooklyn, N. Y. The bale tie bands or hoops, according to this improvement, are connected by end loops with hooks adapted to be hooked one upon the other, the hooks having at their hook ends laterally projecting lugs adapted for engagement by the prongs of an unfastening lever, whereby a bale may be conveniently opened without cutting or destroying the tie fastener.

COVERING FOR RUNWAYS, ETC.—Frank J. Lennon, New York City. In the runways of stables, by which horses pass from one floor to another, and for other similar uses, this invention provides a floor covering designed to afford a secure foothold and prevent slipping. It is formed of narrow elastic strips of rubber or similar material, put on in tubular or looped form, and with their edges overlapping, thus protecting the fastening devices by which the strips are held in place.

SCREEN.—George D. Henry, West Grove, Iowa. This screen contains a removable panel constituting a fly trap, while not interfering with the external appearance of this section of the screen, the trap also having a bait holder which will be inaccessible to the flies and a concentrating chamber into which most of the flies will find their way, provision being made for readily emptying the trap of the flies caught.

FOLDING COT.—Edwin F. Tilley, New York City. This is a cot which may be easily folded into compact form, to take up the least possible space. It consists of a mattress frame to which end posts are connected by links, the frame having extended angle irons formed with notches in each portion to receive two parts of the respective posts, the dual connection affording a more secure and rigid structure.

BROOM.—James Bowell, Port Arthur, Canada. As a new article of manufacture, this inventor provides a broom of broom corn and a fabric web, the latter extending lengthwise and from side to side about centrally of the broom, and being held in such position by the binding wires or threads. The broom is thus designed to sweep the finest dust, and the fabric forms a backing for the layer of broom corn at either side, the efficiency and wear of the broom being thus greatly increased.

WINDOW SASH.—Charles C. Miller, Brooklyn, N. Y. To prevent rattling of the sash in its casing, on account of atmospheric changes, this inventor provides a yielding attachment for the side rails, and to which the weight cord is attached. It comprises a metal boxing adapted to slide in the casing and a metal shell secured to the side rail of the sash, while springs secured to a reinforce strip in the shell bear against the inner surface of the boxing. The shell and boxing are so connected that the sash may be readily removed when desired.

FOLDING BABY CARRIAGE.—George Mayer, New York City. This carriage is designed to fold both longitudinally and laterally, and to be of more simple construction and more easily operated than baby carriages heretofore made. The axles are formed of jointed sections, and a coupling extending from one axle to the other is capable of folding laterally with the body portion of the vehicle, the end portions of the body being also jointed and mounted to swing forwardly and rearwardly.

WASHBOARD HOLDER.—James A. W. Sears, Escanaba, Mich. This holder has telescopic sections adapted for adjustment upon each other for any width of washboard, there being at the end of each section clamping devices for fitting the holder upon the washboard and attaching it to a tub of any diameter, in such manner that the washboard may be conveniently swung into and out of the tub as desired.

PUZZLE.—Stephen A. Bartlett, Demarest, N. J. This puzzle is designed to imitate "Chickens in the Garden," and comprises a suitable base on which is a circular casing in which is arranged a series of channels around a goal, a pen, and gates swinging open in one direction controlling the ends of the channels. The balls are made to travel in the various channels by tilting the base, and considerable skill is called for to thus assemble the balls at the goal.

Designs.

PAPER CUTTER.—James Slater, New York City. This design is for a paper cutter shaped to simulate the heel, instep, and pointed sole of a slipper, with a high and small heel and highly arched instep.

BRUSH CORE.—Henry M. Livor, New York City. This design has a cylindrical core, with a helical groove in its cylindrical surface, the groove having at intervals widened and deepened portions.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

LA MECANIQUE GENERALE AMERICAINE. By Gustave Richard. Paris: J. B. Bailliere et Fils. 1896. Pp. 630. 4to. 1441 illustrations. Price $2.40.

This work has special reference to the machinery and industry represented at the Columbian Exposition of 1893. The illustrations are very largely obtained from trade catalogues. It will without doubt serve a useful purpose in giving French manufacturers a better idea of our machinery and manufactures.

HOW TO SHOOT A REVOLVER. A simple and easy method of becoming an expert revolver shot. By Major William Preble Hall, U.S.A. Washington: The Army and Navy Register. 1895. Price 50 cents.

The author has a well deserved reputation as one of the best revolver shots in the United States, having won six of the medals the government awards each year to the best revolver and carbine shots in the cavalry. This little pamphlet is certainly deserving of a large circulation, for it has been proved repeatedly that the average soldier and policeman, the police especially, are extremely bad shots with a revolver.

TRANSACTIONS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Vol. XVI. New York: Published by the Society. 1895. Pp. 1209. 8vo. 326 illustrations, portrait.

This portly volume gives, in addition to the proceedings of the various meetings of the society, a series of most valuable papers, which are freely illustrated, read by members of the society. Among these papers are articles on improved forms of steam separators, centrifugal governor, drawing office appliances, some tests of the strength of spruce columns, stresses in the rims of pulleys and fly wheels, rail pressures of locomotive guiding wheels, rustless coatings for iron and steel, the theory of the moment of inertia, the development of electric tramways, a portable disinfecting plant, a new shaft governor, new forms of friction brakes, pipe covering tests, efficiency of boilers, etc.

SHOP KINKS AND MACHINE SHOP CHAT. A series of over five hundred practical paragraphs in familiar language, showing special ways of doing work better, more cheaply and more rapidly than usual. By Robert Grimshaw, M.E., etc. New York: Norman W. Henley & Company. 1896. Pp. 393. With 222 engravings. Price $2.50.

This work, by the well known and popular author, Robert Grimshaw, is one of those that seems to possess the capability of taking the ordinary workman, to a certain extent, out of himself, and of causing him to leave the grooves of conservatism and to originate his own methods. The book, in other words, is of the suggestive order. In its well printed pages we find described any number of excellent methods and hints for the machinist presented in the lively style which has become identified with the author. Many illustrations are given and each hint consists of a paragraph with full type headings, so that anything can be readily found. But one portion of the work which we must commend especially is the index, to which some thirteen closely printed pages are given, making a most complete reference table for the somewhat varied matter contained in the book. The illustrations, of which there are 222, are fresh and new, and excellent examples of the illustrator's art. As an excellent example of the author's style, his dash and the personal element strongly presented, we refer to the concluding section under the heading "Emergencies." But it is not fair to note only a single section; everywhere throughout the book will be found excellent suggestions put in the same practical and graphic style. Correct treatment of files, a new style of center gage, illustrated, the evils of the set screw, good and bad types of boiler calking tools, straightening bent taps, are samples of the matter treated. The book will meet with appreciation from all interested in mechanics.

BICYCLE REPAIRING. A manual compiled from articles in the Iron Age. By S. D. V. Burr. New York: David Williams. 1896. Pp. 166. Price $1.

This excellent and fully illustrated work is peculiarly timely. It describes various repairs which have to be executed on bicycles, incidentally, of course, touching largely upon the construction of the modern cycle. The author's well known standing as an engineer and writer has been supplemented in the production of this work by suggestions and information from manufacturers of bicycles. With a view to future editions, an invitation is extended to all who are interested in the subject to send in further information and suggestions. It must not be supposed that the work is intended only for bicycle repairers; it will be of considerable interest and value to the owners of bicycles, enabling them to execute their own repairs or possibly to intelligently supervise their execution by others. The intelligent cyclist wants to know his wheel, and wants to feel that he can recognize its needs in case of accident or of adjustment. This book in popular style will put him in possession of precisely the points he requires, and will help him to know whether repairs have been executed properly and what is a reasonable charge for the same.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6725) C. F. K. asks (1) how to fasten carbon on to copper or brass so it makes a good electrical contact. A. Electroplate the carbon with copper and if necessary solder the copper or brass connections thereto. The simple contact connection should suffice. 2. How many feet of No. 23 wire (A. W. G.) have a resistance of 17 ohms? A. Approximately, 822 feet; practically, a less quantity will probably give the resistance named.

(6726) H. S. asks for the conducting power of aluminum compared with gold or copper for lightning rods or points for rods. A. The modern views of lightning protection do not make the true conductivity of the rod the only factor in its efficiency. Some consider iron as good as copper. The SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 596, 906, 976, 998, and 1035, gives most excellent papers on the subject of lightning rods, and we refer you to them for fuller treatment of the subject. Price 10 cents each by mail. Aluminum has about six-tenths the conductivity of copper. It would make fairly good points.

(6727) A. W. asks how to make a simple electromagnet. A. For information concerning electromagnets we refer you to our SUPPLEMENT, Nos. 182, 777, 778, 779, 780, 781, 784, 785, 786, 788, 789, price 10 cents each by mail.

(6728) H. W. C. asks: What can I put into glue that has been dissolved in whisky but does not remain liquid when temperature gets below 70°? I do not want to use acids, as they weaken the glue. A. Try the addition of glycerine or of alcohol.

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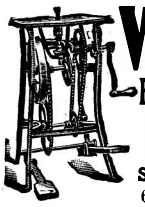

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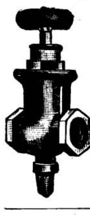

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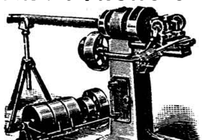

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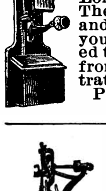

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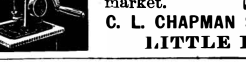

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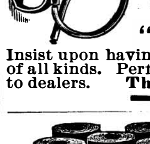

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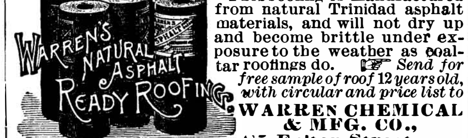

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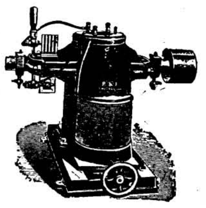

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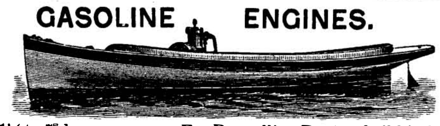

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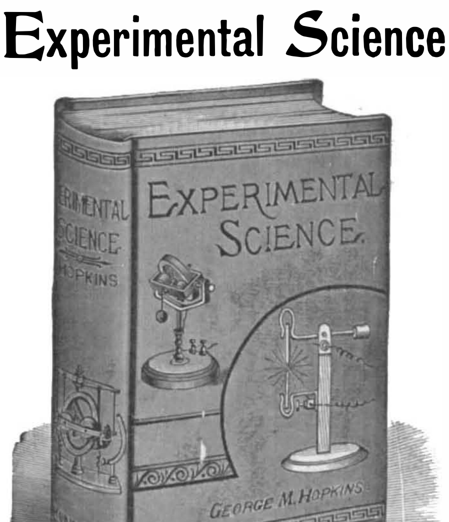

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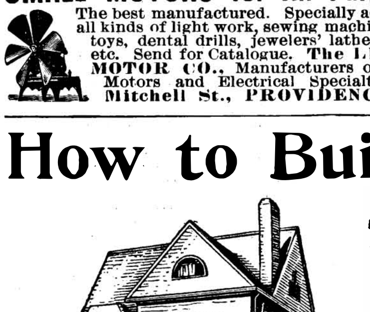

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